RADIO & TELEVISION NEWS

MAY
1951
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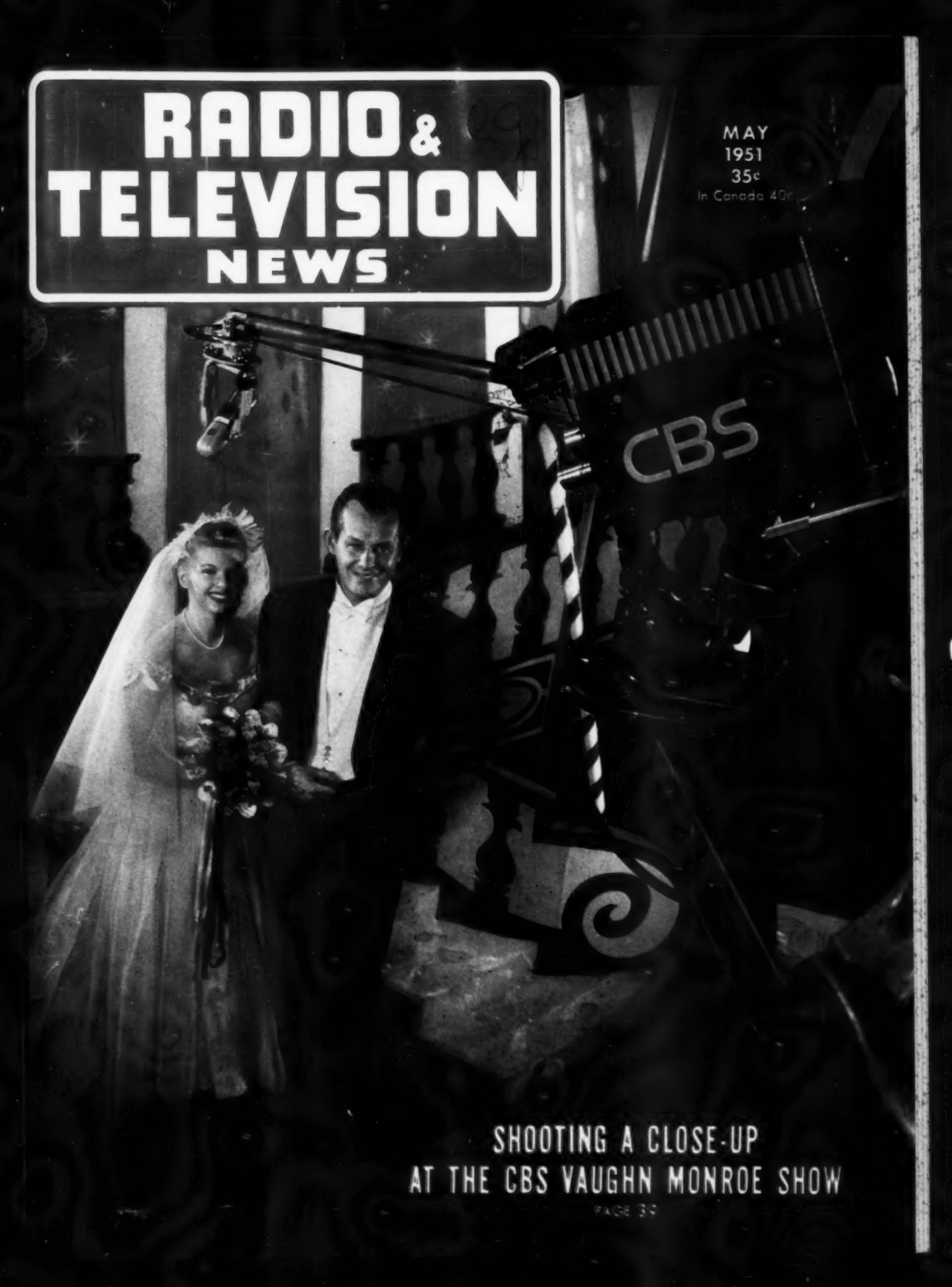


SHOOTING A CLOSE-UP AT THE CBS VAUGHN MONROE SHOW

PAGE 35

THE QUALITY OF **RCA** TUBES IS UNQUESTIONED

Profit Twice...

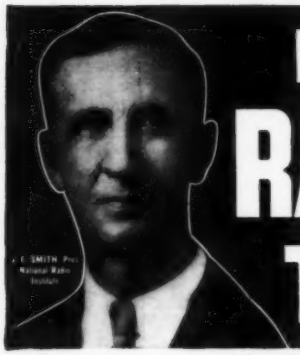
with RCA picture tubes

PROFIT ONCE—The largest and most profitable replacement business in television picture tubes comes from the types used in most television receivers . . . the fast-moving RCA types. That's true today . . . and it will be true tomorrow. Because they are high-volume types, RCA picture tubes simplify your inventory and stocking problems.

PROFIT TWICE—In addition, when you sell RCA picture tubes, you gain from customer confidence in the RCA brand . . . solidly established by the proved performance of RCA picture tubes in millions of television receivers. Their quality and dependability mean fewer service failures and fewer costly call-backs.

Keep informed...stay in touch with your RCA Tube Distributor

RADIO CORPORATION of AMERICA
ELECTRON TUBES HARRISON, N. J.



BE A SUCCESS AS A RADIO-TELEVISION TECHNICIAN

2 FREE BOOKS SHOW HOW — MAIL COUPON

America's Fast Growing Industry Offers You

VETERANS
Get this training under G.I. Bill
MAIL COUPON!

1. EXTRA MONEY IN SPARE TIME

Many students make $5, $10 a week extra fixing neighbors' Radios in spare time while learning. The day you enroll I start sending you SPECIAL BOOKLETS to show you how to do this. Tester you build with parts I send helps you service sets. All equipment is yours to keep.

2. GOOD PAY JOB

Your next step is a good job installing and servicing Radio-Television sets or becoming boss of your own Radio-Television sales and service shop or getting a good job in a Broadcasting Station. Today there are over 90,000,000 home and auto Radios. 3100 Broadcasting Stations are on the air. Aviation and Police Radio, Micro-Wave Relay, Two-Way Radio are all expanding, making more and better opportunities for servicing and communication technicians and FCC licensed operators.

3. BRIGHT FUTURE

And think of the opportunities in Television! In 1950 over 5,000,000 Television sets were sold. By 1954 authorities estimate 25,000,000 Television sets will be in use. Over 100 Television Stations are now operating, with experts predicting 1,000. Now is the time to get in line for success and a bright future in America's fast-growing industry. Be a Radio-Television Technician. Mail coupon for Lesson and Book—FREE.

I TRAINED THESE MEN

Chief Engineer, Police Radio
"Soon after finishing the N. R. I. course, worked for servicing shop. Now I am Chief Engineer of WCUN, WNRN, WSPK, two-way FM Police Radio installations." S. W. DENWIDDIE, Jacksonville, Ill.

Shop Specializes in Television
"Have my own shop. Am authorized serviceman for 5 large manufacturers and do servicing for 7 dealers. N.R.I. has enabled me to build an enviable reputation in Television." P. MILLER, Maumee, O.

Over $40 Month Spare Time
"When I enrolled, had no idea it would be so easy to learn. Have equipped my shop out of spare time earnings. I am clearing about $40 to $60 a month. Full credit to N.R.I." — J. D. KNIGHT, Denison, Texas.

NRI Graduate Doubles Salary
"Am with Station WKBO as transmitter operator. Have more than doubled salary since starting in Radio. Future looks bright. N. R. I. has been constant help to me."—A. HERR, New Cumberland, Pa.

$10 Week in Spare Time
"Before finishing your course, I earned as much as $10 a week in Radio servicing, at home in my spare time. I recommend N.R.I. to everyone who shows interest in Radio."S. J. PETRUFF, Miami, Fla.

Years of Success with Shop
"I operate my own shop and have over 500 customers. My profits average about $220 a month. Have had years of successful experience and I still praise N.R.I. training." J. R. ANDERSON, Atlanta, Ga.

Gets First Job Through N.R.I.
"My first job was operator with KDLR, obtained for me by your Graduate Service Dept. I am now Chief Engineer of Police Radio Station WQOX." T. S. NORTON, Hamilton, Ohio.

Regrets Not Enrolling Before
"Am proud of my diploma. I cannot say enough for the N. R. I. course. Regret I didn't take it years ago when I used to see your ads. Now I have a spare time shop." FRANK S. TUCKER, Hilton Village, Va.

I Will Train You at Home

Read How You Practice Servicing or Communications with Many Kits of Parts You Get!

YOU BUILD this modern Radio (above) as part of my Servicing Course. Build this complete, powerful Radio Receiver that brings in local and distant stations. N.R.I. gives you ALL the Radio parts . . . speaker, tubes, chassis, transformer, sockets, loop antenna, EVERYTHING you need. You use material to get practical Radio experience. Make EXTRA money fixing neighbors' Radios in spare time while training.

YOU MEASURE current, voltage (AC, DC and RF), resistance and impedance in circuits with Electronic Multitester (above right) you build as part of my Servicing or Communications Course.

YOU BUILD this Transmitter (right). As part of my Communications Course, I SEND YOU parts to build this low-power broadcasting transmitter. You learn how to put a station "on the air," perform procedures demanded of Broadcast Station operators, make many practical tests.

YOU BUILD this Wavemeter (below) in my Communications Course with parts I send you. Use it to determine frequency of operation and make other tests on transmitter currents. You conduct many interesting experiments.

Keep your job while training at home. Hundreds I've trained are successful RADIO-TELEVISION TECHNICIANS. Most had no previous experience; many no more than grammar school education. Learn Radio-Television principles from illustrated lessons. Get PRACTICAL EXPERIENCE—build valuable Electronic Multitester for conducting tests; also practice servicing Radios or operating Transmitters—experiment with circuits common to Radio and Television. At left is just part of the equipment my students build with many kits of parts I furnish. All equipment is yours to keep. Many students make $5, $10 a week extra fixing neighbors' Radios in spare time.

Mail Coupon For 2 Books FREE

Act Now! Send for my FREE DOUBLE OFFER. Coupon entitles you to actual lesson on Servicing; shows how you learn Radio-Television at home. You'll also receive my 64-page book, "How to Be a Success in Radio-Television." You'll read what my graduates are doing, earning; see photos of equipment you practice with at home. Send coupon in envelope *or* paste on postal. J. E. SMITH, Pres., Dept. 1EE, National Radio Institute, Washington 9, D. C. . . . Our 38th year.

Good for Both—FREE

Mr. J. E. SMITH, President, Dept. 1EE
National Radio Institute, Washington 9, D. C.

Mail me Sample Lesson and 64-page Book about How to Win Success in Radio-Television. Both FREE. (No salesman will call. Please write plainly.)

Name ..... Age .....

Address .....

City ..... Zone ..... State .....

☐ Check if Veteran — Approved Under G. I. Bill

COVER PHOTO: Scene from the CBS "Vaughn Monroe TV Show". Elaborate variety shows such as this require close coordination by artists, cameramen, directors, monitors, etc. (Ektakrome by Stahman & Warnecke)

First in
radio-television-electronics
Average Paid Circulation over 200,000

RADIO & TELEVISION NEWS

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Radio News Trademark Reg. U. S. Pat Office • Television News Trademark Reg. U.S. Pat. Office.

CONTENTS MAY, 1951

DEPARTMENTS

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VOLUME 45 • NUMBER 5

Member
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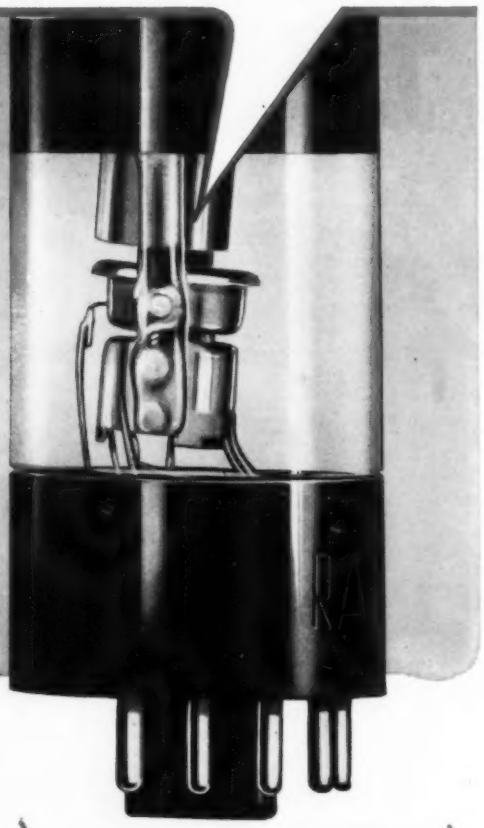
NEW INDICATOR ION TRAP

a Rauland "Exclusive"



Speeds Service—Builds Profits

Rauland's new Indicator Ion Trap is winning the cheers of more service men and dealers every day—because of the time and trouble it saves in Ion Trap Magnet adjustment, and because it eliminates mirrors and guesswork.

Now it's a matter of seconds to adjust the ion trap magnet with absolute precision. The service man simply moves the magnet until the signal glow is reduced to minimum.

This important new Rauland development is incorporated in all Rauland tubes produced today—as a feature of Rauland's new Tilted Offset Gun. This gun offers the additional advantages of giving only a single Ion Trap Magnet and of maximum sharpness of focus.

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For further information, write to...

RAULAND

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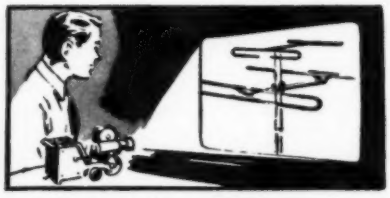
LOOK . . . *You get the tape recorder and projector right at the start of your course!*

HEAR *your instructor*

It's even better than the classroom, because you can *repeat* the instructor's lectures until they're thoroughly understood.



SEE *2000 illustrations*

You learn quicker when you see diagrams and illustrations in *blackboard size.*

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You get the famous "TRANSPONDER" precision built, high fidelity tape recording machine with your very first lesson—*and* a powerful projector with which you can view diagrams and illustrations enlarged to a size that makes them easy to see and understand.

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Tell your instructor about anything that puzzles you and get his answers back pronto.

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Millions of television set owners are demanding qualified television technicians to service their sets. There is a tremendous shortage of such qualified men today and will be for many years to come. Get in on the ground floor of this booming industry and be prepared to accept a steady, big pay job for life. We can qualify you quickly, easily, surely—and help get you a job when you complete your course. Send for illustrated booklet that gives the complete details.

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For the RECORD

BY THE EDITOR

RADIO & TELEVISION'S MORALE VALUE

IT IS estimated that over 30,000,000 people, through the medium of television, and countless millions of radio listeners, either saw or heard our Government in action during the Senate crime hearings. The reactions to these broadcasts and telecasts clearly indicate that we, in this country, are the best informed citizens in the entire world. Here in the United States we have long had the privilege of enjoying, or should we say have been blessed with, such things as "freedom of the press." We have learned to tolerate many stupid commercials as part of our radio and television programs, knowing that without them it would be impossible to enjoy such excellent program material unless such entertainment were sponsored by the "free enterprise" system of our country.

The public has had a very real opportunity to witness the tremendous educational value of television, as well as radio. Our GI's too, through the facilities of radio, are constantly in touch with home and with Federal action through the medium of the Armed Forces Radio Service.

We had the opportunity, but a few weeks ago, to travel with personnel of the AFRS on assignment to Travis Air Base in California. Our mission was to take color cover shots of the remote recording crew in action, and to observe the techniques used by the AFRS in the recording of programs for subsequent dubbing, pressing, and distribution to our GI's throughout the world. But that is a story in itself and will be told in a later issue. The point we would like to stress is that the morale of the American GI, and we were able to interview many, is maintained at a high level through news from home and from "de-commercialized" entertainment broadcast through the AFRS channels comprising the largest radio network in the world. AFRS overseas outlets now total 60 standard wave broadcasting stations. In the zone of the interior, its bedside network consists of 46 carrier stations in the Army, Navy, and Air Force hospitals.

In its overseas transcription activities, AFRS writes and broadcasts about 16 hours of programs. About 40 hours of programs are taken from the major networks and de-commercialized. Approximately 60 musical numbers are recorded weekly for the basic music library and distributed to Army, Navy, and Air Force Stations. All overseas transcriptions are shipped by high priority air. At present the AFRS moves about 40,000 sixteen-inch, 33⅓ r.p.m. vinylite transcriptions monthly. Its short-wave operations are maintained from both Los Angeles and New York. AFRS is on the air 510 broadcast hours per month over 11 powerful transmitters on both coasts. The west coast transmissions total 1777 transmitter hours per month over seven of these transmitters and the east coast 450 hours over the other four.

We also had the opportunity of visiting the home plant of AFRS in Hollywood, which is equipped with three recording studios, a recording room or control center, a master control room for short-wave broadcasting, and 12 sound-proofed audition tanks (used for editing and de-commercializing), a modern and well-equipped maintenance shop staffed by expert audio men, a tape assembly studio, a remote recording section, and office space occupied by the technical production branch.

The majority of original recordings are made on magnetic tape, using *Ampex* and *Stancil-Hoffman* units. Each machine is checked daily for frequency response, distortion, and mechanical difficulties. The recorded tape master is later transferred to acetate by dubbing and subsequent processing and pressing.

The Remote Recording Section completes about 30 remotes a month and recordings are made under wide and varied conditions. The recording crew is called upon to "take" everything from an interview to a concert.

Under the capable direction of Col. W. M. Wright, Jr. and his staff, the facilities of AFRS have expanded into what is perhaps the largest single radio network in the world. The American GI will tell you that the AFRS has, and is, keeping him in close touch with news, sports, and other happenings back in the states.

AFRS today has, according to a State Department estimate, a worldwide listening public of over 90,000,000 persons. Although its primary function is to serve servicemen overseas, it recognizes its responsibility to give its large non-service audience an undistorted picture of America and Americans, while it attempts to make a spokesman for democratic good-will of every United States serviceman stationed abroad.

Our Industry, meeting *en masse* at its annual convention in Chicago this month, may point with pride to the educational and morale building contributions made possible by our mass production of radio and television products for the GI and the American people. . . . . O.R.

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where BLACK IS BLACK - WHITE IS WHITE - *and between* ALL THE NATURAL INTERMEDIATE SHADING!

This FULL RANGE of picture tones seen only on Sheldon "Telegenic" Picture Tubes, makes possible MAXIMUM CONTRAST with CLARITY . . . with NO EYE STRAIN and NO GLARE . . . whether on a Velour Black or clear face screen . . . whether viewed in daylight or under artificial light.

Superior picture quality is the reason why Sheldon Picture Tube production has been stepped up to 5,000 daily! This production increase is made possible by another recent installation of the most modern in-line exhaust unit in the industry.

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WRITE FOR VISUAL PROOF OF SHELDON'S SUPERIOR PICTURE QUALITY!

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Send ☐ Proof of Picture Quality
☐ "Characteristics and Dimensions" Wall Chart
☐ "Television Mis-Information"
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(They're free — but PLEASE PRINT)

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You receive all parts, including tubes, for building this fine, modern Superheterodyne Receiver. This and other valuable standard equipment becomes your property.

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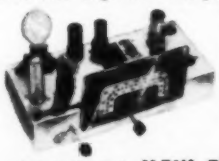

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This versatile testing instrument is portable and complete with test leads. Simple to operate, accurate and dependable. You will be able to quickly locate trouble and adjust the most delicate circuits. You can use the Multitester at home or on service calls. It is designed to measure AC and DC volts, current resistance and decibels. You will be proud to own and use this valuable professional instrument.

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National Schools Master Shop Method Home Training gives you basic and advanced instruction in all phases of Radio, Television and Electronics. Each lesson is made easy to understand by numerous illustrations and diagrams. All instruction material has been developed and tested in our own shops and laboratories, under the supervision of our own engineers and instructors. A free sample lesson is yours upon request—use the coupon below.

TELEVISION TRAINING A complete series of up-to-the-minute Television lessons is an integral part of your course, covering all phases of Television repairing, servicing and construction.

Here are just a few of the interesting facts you learn with the **FREE SAMPLE LESSON**

1. How radio receivers operate.
2. How the antenna circuit is constructed.
3. Converting signal currents into sound.
4. How the R-F transformer handles the signal.
5. How the tuning circuit functions.
6. The Radio "bands."

APPROVED FOR VETERANS Check coupon below.

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Mail me FREE the book "Your Future in Radio-Television" and the sample lesson of your course. I understand no salesman will call on me.

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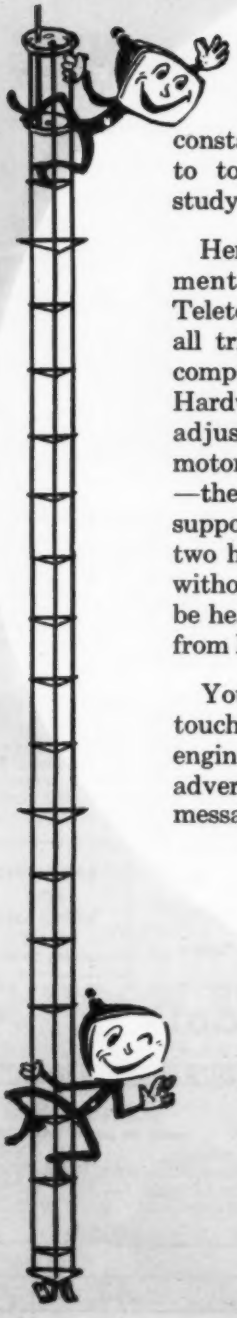
STAY TUNED IN!

Always There's a NEWS *Program from the* TELETOWER



Teletower always has . . . does . . . and always will . . . place "high priority" upon development engineering. It was constant design study that pushed Teletower to top position in sales. *Continuing* design study will keep it "the tower in your future."

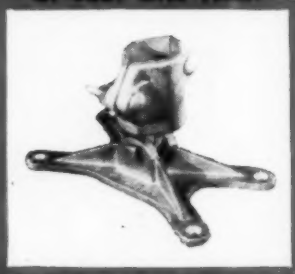
Here are just a few of Teletower's development engineering achievements: (1) The Teletower itself . . . today's "best seller" among all tripods—(2) The Thriftower . . . the field's competitive-price leader—(3) The Tenna-Mast Hardware line of pole base mounts—(4) The adjustable roof mount—(5) The universal motor mount—(6) The built-in base—(7) And —the very newest—a "revolution" in antenna supports: the *new* baseless tower that supports two hundred and fifty pounds of stack weight without using a single strand of guy wire! You'll be hearing *plenty* more about this one soon . . . from Penn . . . from dealers . . . from set-owners.

You'll be robbing your future if you lose touch with today's developments in tower engineering. Watch this publication for our advertising . . . and watch your mail for timely messages from the Teletower.

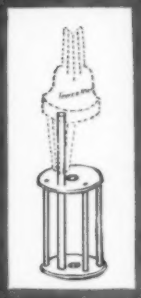
STAY TUNED IN . . .

TO *Teletowers!*

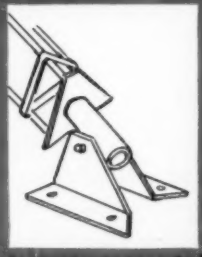
A FEW DEVELOPMENT ENGINEERING ACHIEVEMENTS OF JUST ONE YEAR!



Pole Base Mount. Durable aluminum base with adjustable socket to accommodate 1" O.D. tubing to 2" pipe. Competitively priced.



Universal Motor Mount. Fixed pole extending 9" beyond top of tower makes this mount easy to adapt to all antenna rotors. Centers on Alliance . . . firm, off-center mounting for other types.



Built-in Base. Permits raising tower on severest slope *after* base is fastened to roof. Heavy plate takes tower thrust.

PENN *Teletowers Thriftowers Tenna-Mast*

PENN BOILER AND BURNER MFG. CORP.
LANCASTER, PA.

TONE ARMS— STYLI

Type RPX-041

Type RPX-050 (Triple Play)

...still available
...still tops

PRODUCT shortages? Sure. But there's *never* a letdown in the *quality* of G-E phono-accessories . . . and the items shown above are still available to manufacturers, jobbers, dealers and servicemen.

The G-E tone arm is built to accommodate the famous G-E Triple Play Cartridge (also in stock). It's equipped with ball bearings for smooth lateral movement . . . special light weight alloy keeps the arm mass to a minimum . . . stylus pressure is *constant at 6-8 grams for all three speeds* to reduce record wear. Plainly marked selector knob projects through the top of the arm—a single twist places either stylus in playing position.

General Electric's high compliance Baton Stylus with diamond or sapphire tip is unsurpassed in its field. Stock it in quantity—give your customers listening quality that lasts.

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GENERAL ELECTRIC

Spot Radio News

★ ***Presenting latest information on the Radio Industry.***

By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

THE TV FREEZE, which on many occasions seemed to be all set for a general defrosting, but still remained in the locker, may now soon really see that momentous release stage and the end of its three-year stay in the ice cells of Washington, according to the release of an official edict from the Commission.

In an encyclopedic report, noting that the FCC is proposing a . . . *"partial lifting of the TV freeze"* . . . it was disclosed that a new plan had been prepared providing, technically, for nearly 2000 ultra-high and very-high stations in more than 1200 communities, as compared with about 400 stations in 140 market areas under the present channel assignment plan.

The ultra-high portion of the spectrum received the bulk of the new allocations in the proposal, with from 65 to 70 six megacycle bands suggested, the number depending on a decision, yet to be reached, as to the ultimate use of the 470 to 500 megacycle band (five channels), which the telephone companies have requested for mobile operations. Thus, if the phone utilities do not win the band, the first of the new channels, or Channel 14, will begin at 470; otherwise Channel 14 will be located at 500 megacycles.

A gain of ten channels is indicated in the new plan, or fifty-two against forty-two suggested in the July 11, 1949 program, with thirteen or eighteen channels being set aside for supplemental and experimental work. The intermixing plan, one of the most debated issues during the hearings, appeared to impress the Commissioners, and thus provisions for mixing the ultra-highs and very-highs, or Channels 14 to 65 and 2 to 13, were included in the allocation schedule. Supporting this view, the Commission said that it was reasonable to assume that the economic problems will be faced by broadcasters who enter the new channels, in areas where the two-to-thirteen telecasters are in operation. However, similar problems confronted the very-high broadcasters prior to increased receiver distribution in their respective areas. Therefore, declared the Commissioners, if the entire ultra-high band should be allocated for regular television broadcasting, all receivers will have to be built to receive both types of bands. If the intermixture were avoided, there might be receiver design and distribution confusion, and it would be necessary to limit many areas to one or two standard band stations, even though ultra-high assignments were available and additional stations could be supported financially, the gentlemen from Washington argued. Moreover, they pointed out, very-high stations are capable of providing a greater coverage than the new band type stations. Hence a more extensive service will become available where some very-high assignments appear in as many communities as possible, than where only very-high assignments appear in some areas, and only ultra-high provisions are made in the other communities. In their opinion, the adoption of any non-intermixture program would constitute a short-term view of the problem.

The new plan will undoubtedly provoke quite a few broadcasters who are being asked to shift their channels. Specifically, there are thirty-one alterations suggested. In Cleveland, Syracuse (New York) and Rochester (New York), the Commission has indicated that WXEL should use Channel 8 instead of 9; WSYR-TV use Channel 3 instead of 5; and WHAM-TV go to Channel 5 and give up Channel 6. These changes were recommended to provide a more equitable distribution of channels between this country and Canada. Interference reduction was offered as the need for the suggested alterations for the remaining 28 channels. In the main, the new assignments involve a shift of a channel above or below. However, there are several who are being asked to accept a healthy switch in frequencies. For instance, WTTV in Bloomington, Indiana, may have to drop to Channel 4, from its present 10; WBKB, Chicago, from 4 to 2; WSB-TV, Atlanta, Georgia, from 8 to 11; WHIO-TV, Dayton, Ohio, from 13 to 7; WJAC-TV, Johnstown, Penna., from 13 to 6; WHAS-TV, Louisville, Kentucky, from 9 to 11; WTAR-TV, from 4 to 10; and WDEL-TV, Wilmington, Delaware, from 7 to 12.

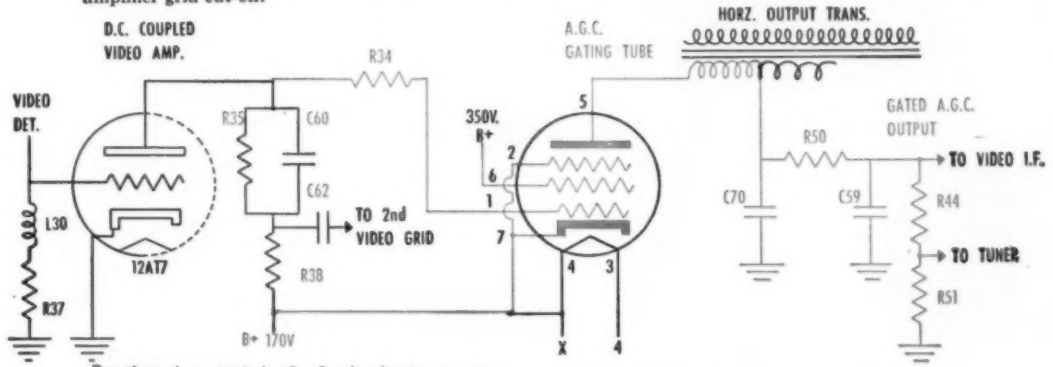
Power increases represent another highlight of the new plan, with population being a major factor in the determination, and interference also being considered. A minimum effective radiated power of 50 kilowatts has been suggested for a station serving a city with a population of a million or more; 10 kilowatts for one catering to

Service Clinic!

Latest information to help you better service Raytheon

Gated automatic gain control has been specially designed for use in TV receivers. This type of A. G. C. is superior because it utilizes a gating horz.-pulse plate supply that eliminates approx. 87% of the noise admittance into the A. G. C. system. Note that the local noise interference shown in Fig. 2 can only be effective during the gated Ip conduction area shown in Fig. 1 and here the station sync. tips are noise clipped by the 1st video amplifier grid cut-off.

Gated or keyed A. G. C. also has another important operating characteristic. The plate gating pulse, being of a time interval corresponding to the station horz. sync. pulse, gates out the station vertical sync. pulse. This greatly reduces the amount of 60 cy component which would normally be injected into the A. G. C. filter. Thus a filter of faster time-constant may be used to reduce airplane flutter.



Raytheon's gated A. G. C. circuit above uses a 6AU6 gating tube that is D. C. coupled to the video detector through the 1st video amplifier. The only plate supply is the pulse furnished by the horz. output transformer as shown in Fig. 1. Note that the cathode of the gating tube is tied to B+ (170 volts) and that the grid is directly coupled to the plate of the 12AT7 through R34 (R34 reduces grid loading effects on video response). The input signal and D. C. voltage drop (bias), in Fig. 2, developed across the 12AT7 plate load (R35, C60 and R38) are applied between the grid and cathode of the gating tube. The plate current supplied by the horz. output transformer passes through the A. G. C. filter (C70, R50 and C59) developing the negative A. G. C. output voltage across R44 and R51.

Improved circuitry such as this is one of many reasons why you can feel free to recommend Raytheon TV to a friend or a customer.

FIG. 1–INSTANTANEOUS PLATE VOLTAGE

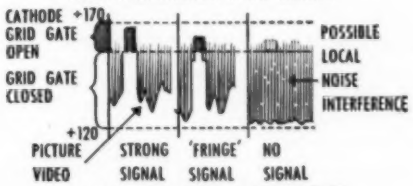


FIG. 2–INSTANTANEOUS GRID VOLTAGE

a population of between 250,000 and a million; 2 kilowatts for service to 50,000 to 250,000; and 1 kilowatt for those areas with a population under 50,000. In each instance, the powers would vary with the heights of the antenna. Super powers may also be permitted, with 100 kilowatts for the 2-to-6 channel stations and 200 kilowatts for all above, or Channels 7 to 83.

Reviewing the city-to-city separations which are believed to be tolerable with higher powers and other changes, the Commission stated that because of the improvements which can result from offset carrier operation, it would only be necessary to have minimum co-channel separation of 180 miles for the 2-to-13 channel stations and 165 miles for the higher-band stations. Previously, separations of 220 and 200 miles had been proposed. For transmitters operating on the same channels, the minimum separation would be 170 miles for the very-high stations and 155 miles for the ultra-high occupants. The adjacent-channel separation scene has been modified, too, with normal separations of 70 miles recommended for the very-high band and 65 miles for the new band stations, instead of 110 and 100 miles previously believed to be necessary. Minimum separation of transmitters operating on the adjacent channels could be 60 miles for the present-band systems and 55 for the newer stations. Generally, declared the Commission, adjacent-channel interference has not been of a serious nature and such problems as do exist can be solved to a very considerable extent by improvements in receiver design, which are neither difficult nor costly. This belief led to the reduction in city-to-city separation, thus making possible a greater number of assignments.

Set manufacturers were told in the report that they were expected to use the 41.25 megacycle intermediate frequency adopted by the RTMA, and that, in addition, efforts were to be made to reduce oscillation radiation.

The territories of Alaska, Hawaii, Puerto Rico, and the Virgin Islands fared quite well in the new-band plan, receiving a full green light for the very-high channels. Alaska was told that she could have fifteen channels; Hawaii, sixteen channels; Puerto Rico, eight channels; and the Virgin Islands, three channels. In addition, channels were set aside for educational purposes. At present, there are no authorizations or pending applications for TV stations in these areas, and it is expected that it won't be long before the race to file will be a merry one.

Education received quite a block of the spectrum in the allocation setup, with two hundred and nine assignments suggested; eighty-two in the very-high and one hundred and twenty-seven in the ultra-high bands. Pointing out that the need for non-commercial educational TV was amply demonstrated during the hearings,

(*Continued on page* 121)

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Model SX-62

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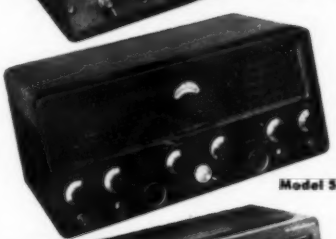

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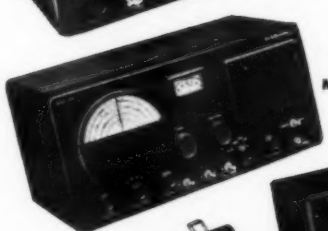
Model S-76—The only double superhet with 50 kc second i-f and the only set now known with a giant sized 4-inch "S" meter. Another new Hallicrafters engineering triumph. One r-f, two conversion, and two i-f stages; temperature compensated, voltage regulated. Range 540-1580 kc, 1.72-32 Mc in four bands Separate electrical bandspread, with calibrated dial. Sensitivity, Volume, BFO Pitch, Selectivity and Tone Controls: AVC, Rec./Standby, BFO, ANL switches. Phonograph input jack. 3.2 or 500 ohm outputs 9 tubes plus voltage regulator and rectifier**$169.50**

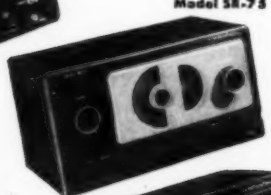
Model S-408, S-77—New version of an old favorite. Temperature compensated oscillator; tuned r-f stage, two i-f stages for better selectivity. Covers 540 kc to 43 Mc in four bands. Sensitivity, volume, three-position Tone, BFO Fitch, controls; AVC, BFO, Rec./Standby, and Noise Limiter Switches. Built-in PM speaker. External power, remote control connections. 7 tubes plus rectifier.....**$99.95**



Model S-408, S-77

Model SR-75—A small transceiver for the novice class or beginning amateur; can also be used later as exciter unit. Receives on 540 kc through 32 Mc, transmits on 10, 11, 20, 40, or 80 meter bands. 10 watts input to final amp. Receiving section is substantially same as our S-38B Bandspread tuning, Speaker/phones switch, BFO switch. Rec./Standby switch; four tubes plus rectifier. Transmitting section uses electron coupled Xtal oscillator plus output tube of receiver. Voltage doubler rectifier to increase plate voltage. 5 tubes plus rectifier. With coils, less crystals...**$89.95**

Model SR-75



Model S-38B—Pulls in broadcast stations in weak signal areas where ordinary sets fail. Also offers world-wide reception for the short-wave listener and the new amateur. Covers Broadcast Band and three short-wave bands, 540 kc to 32 Mc. Separate Fine Tuning control. BFO, Rec./Standby. Speaker/Phones switches. Built-in PM speaker. Four tubes plus rectifier. For 115 V. AC or DC. **$49.50**

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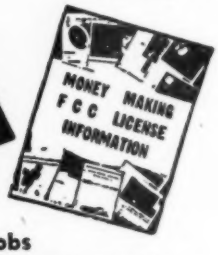

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TELLS HOW— Employers Make

JOB OFFERS Like These to Our Graduates Every Month

Telegram, August 9, 1950, from Chief Engineer, Broadcast Station, Pennsylvania. "Have job opening for one transmitter operator to start immediately, contact me at once."

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Clifford E. Vogt, Box 1016, Dania, Fla.	1st Phone	20
Francis X. Foerch, 38 Beucler Pl., Bergenfield, N. J.	1st Phone	38

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Don't let this offer expire without your getting a copy of this splendid, fact-packed servicing manual. Filled with time-saving shortcuts and valuable servicing hints.

Now it's yours absolutely FREE from your Sylvania Distributor with the purchase of just one Sylvania Picture Tube, of any type. But the offer expires May 31st. So, act NOW! Write or call your distributor TODAY!

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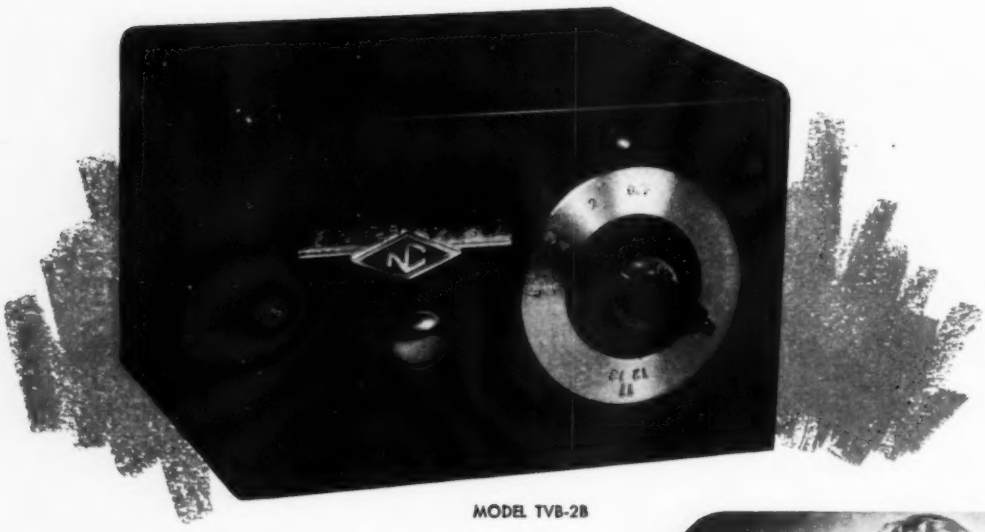

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Basis of the LOAD-CHEK method is the tag or label on every radio and TV chassis which shows the normal power consumption. The following examples are only two of many time-saving uses of this new instrument.

LOCATING A SHORT—The chassis tag may show a normal consumption of 225 Watts. Simply plug the power cord of the chassis into LOAD-CHEK (there are no loose ends to connect or be in the way). Note the reading—which should be possibly 350 Watts. By removing the rectifier tube you can determine at once which side of the tube the short is on. With a soldering iron and long-nosed pliers you can check through the chassis, locate and correct the trouble without having to lay down tools or to check with lead wires!

REPLACING BURNED OUT RESISTORS—With the chassis to be repaired plugged into a LOAD-CHEK MODEL 660, note the wattage reading with the burned out resistor circuit open. Now replace the resistor. Should the increase in watts be greater than that of the resistor rating being installed, it indicates that an extra load has caused the trouble which has not been cleared.

LOAD-CHEK is made-to-order for the busy service man and can help stop costly "come back" repair jobs. It's a profit-maker because it's a Time-Saver. And at its moderate cost LOAD-CHEK can be standard equipment on *every* service bench. *By all means*, inspect this versatile instrument at your distributor and place your order, for under present conditions we must fill all orders on a basis of "First Come, First Served."

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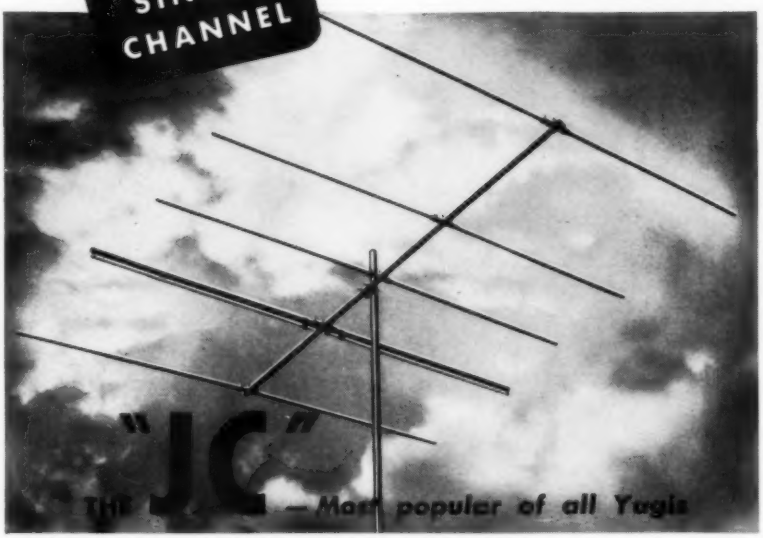

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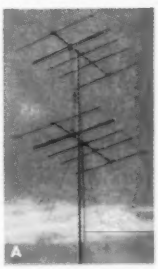
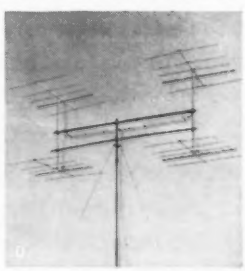
POWERFUL STACKED ARRAYS FOR ALL SINGLE CHANNEL REQUIREMENTS



(A) *Double Stacked JC Array* with half-wave spacing. Provides additional gain and improved signal-to-noise ratio.

(B) *Double Stacked JC Array* with full-wave spacing. Provides highest possible gain in low noise areas.

(C) *Four Stacked Vertical JC Array* provides extremely high gain and excellent improvement of signal-to-noise ratio. Ideal for long distance reception areas with relatively flat terrain.



(D) *Four Stacked Side-by-side JC Array* — a radically new type of array developed for highest gain in hilly and mountainous terrain. Provides powerful long distance reception.

ALL CHANNEL

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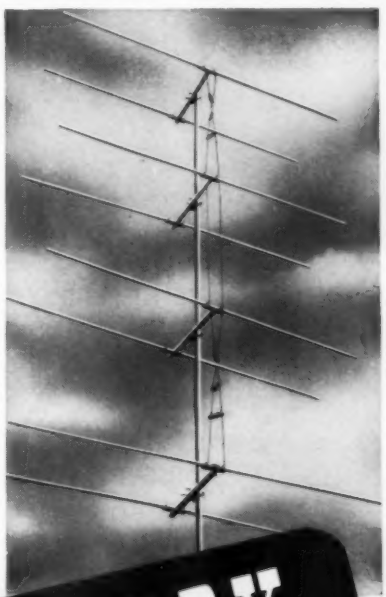
The New Favorite in Areas Where Both High and Low Channel Reception is Required

This exclusive Vee-D-X antenna was developed to fill the need for more powerful all-channel reception in primary as well as fringe areas. Besides producing higher gain throughout the TV spectrum, the Colinear may be cut to any single high channel for sharp directivity, yet will resonate on low channels regardless of high channel selected. Like the Vee-D-X JC Yagi, the Colinear is completely pre-assembled. It is also the lowest priced four-bay array ever manufactured.



VEE-D-X
THE WORLD'S MOST POWERFUL ANTENNAS

Now... CENTRALAB OFFERS POPULAR MAKE TV

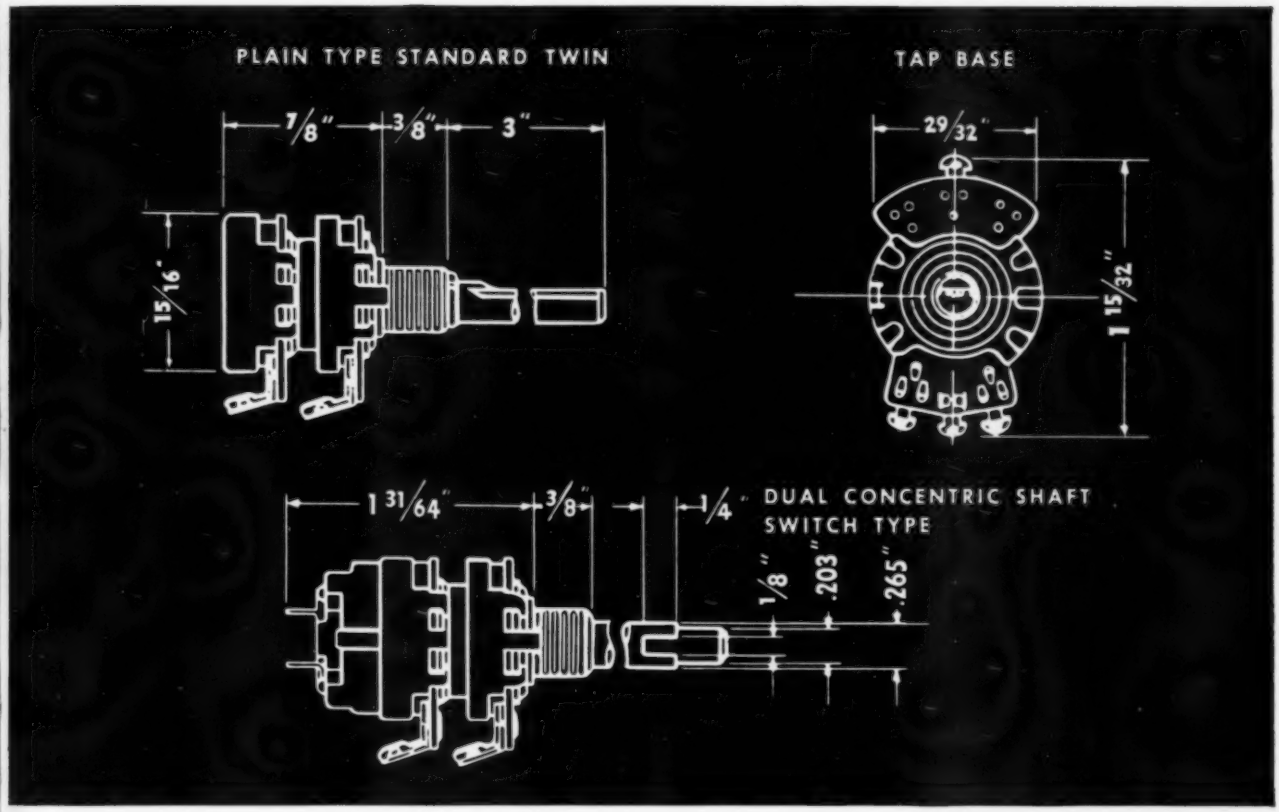
CENTRALAB CUSTOM CONTROLS ARE MADE BY THE OLDEST NAME IN CARBON CONTROLS. Centralab custom controls are made by Centralab, the company that introduced carbon controls to the radio industry — *25 years ago!*

CENTRALAB CUSTOM CONTROLS ARE FACTORY ASSEMBLED AND TESTED — QUICKEST FOR SERVICING. All Centralab custom controls for TV are factory assembled and tested—including switches. They're made to exact replacement specifications and come ready to install.

CENTRALAB CUSTOM CONTROLS SAVE YOU VALUABLE TIME — HELP GUARANTEED SERVICE. Because Centralab Custom Controls come to you ready to install — there's no time lost fumbling around with kit assemblies. What's more, you can be confident of giving guaranteed service with factory-tested controls.

CENTRALAB CUSTOM CONTROLS OBTAINABLE FROM ONE SOURCE. You'll find these Centralab Custom Controls for TV replacement are regularly stocked by leading independent parts distributors. There's no time lost in "shopping around" for the exact replacement part.

CUSTOM CONTROLS FOR SERVICE REQUIREMENTS



CENTRALAB HELPS YOU SOLVE TV SERVICE PROBLEMS

Along with Centralab's Custom Controls for TV replacement comes another big help to service engineers — Centralab's new TV CONTROL GUIDE. It will save you time, money and energy . . . no more "shopping around" for the exact replacement you need. The Centralab TV CONTROL GUIDE contains over 1600 listings of exact replacement controls for nearly all popular makes and models. PLUS — AND THIS IS A BONUS FOR YOU — the industry's *first replacement listing* on Centralab's famous Printed Electronic Circuits! Use the coupon to get your copy of Centralab's new TV CONTROL GUIDE. It gives many dollars' worth of valuable information for only 25¢.

Centralab
CRL
®
Division of **GLOBE-UNION INC., Milwaukee**

NEW!
TV CONTROL GUIDE
WITH FIRST LISTING OF PEC's

·MAIL TODAY·

CENTRALAB DIV. OF GLOBE-UNION INC.
910 East Keefe Avenue, Milwaukee 1, Wisconsin

I enclose 25¢ in stamps or coin for my copy of the new Centralab TV Control Guide which has over 1600 exact listings, plus the industry's first listing of Printed Electronic Circuits.

Name.....

Address.....

City.....Zone.....State.....

Please! I am a ☐ Service Engineer ☐ Ham ☐ Jobber ☐ TV Set-Owner

Within the INDUSTRY

EDWIN B. HINCK has been appointed sales manager of the electronic parts division of *Allen B. Du Mont Laboratories, Inc.*

He succeeds Major Harry Van Rensselaer who has recently been recalled to active duty with the Army Air Force.

Mr. Hinck, active in the electronic industry for the past ten years, has been associated with *Du Mont* since 1943. Aside from his experience in the electronic parts division, at one time Mr. Hinck was northeast sales manager for the transmitter division, covering the territory east of Pittsburgh.

In his new post, Mr. Hinck will be responsible for the introduction and sale to the public of the new products and components manufactured by the division.

* * *

THE BELL SYSTEM has announced that network television has been extended to Binghamton, New York, the 43rd such city receiving network service.

Programs reaching Binghamton travel on both coaxial cable and radio relay. The television signals go over the coaxial facilities as far as Albany where they take to the microwaves and are carried along the Albany-Syracuse radio relay route. At Cherry Valley, New York, two relay points west of Albany, the signals are beamed south to Binghamton via new relay stations at New Berlin and Windsor.

Unlike most relay stations which have antennas mounted on top, the New Berlin and Windsor towers are mounted with 10 by 15 foot aluminum reflectors. Signals from Cherry Valley strike the first reflector and are bounced to a receiving antenna at the base of the tower. After passing through amplifying equipment the signals are beamed from a ground level transmitting antenna which beams them to another reflector and thus on to the next station. The reflector tower at New Berlin is 300 feet high and that at Windsor is 150 feet.

* * *

FREDERICK HART & CO., INC. of Poughkeepsie, New York, has announced that the name of the 57-year-old electronics equipment firm has been changed to the **DAYSTROM ELECTRIC CORPORATION.** The move was in line with the change of the parent company name from **ATF INCORPORATED** to **DAYSTROM, INCORPORATED** . . . A new television manufacturing firm, known as **CADILLAC ELECTRONICS CORP.** has been formed by I. R. Ross. The new organization has headquarters at 3 West 61st Street in New York . . . The newly organized **RADIOPHON CORP.** of New York is the United States affiliate of the French firm **ETS RADIOPHON** of Paris. The company will act as agents for European made radio and electronic parts . . . **CENTRAL TRANSFORMER COMPANY,** with Morton R. Whitman as president and Lloyd G. Shore as secretary-treasurer, has been recently organized in Chicago. The firm, which is located at 910 W. Jackson Boulevard, Chicago 7, Illinois, will specialize in custom transformer design and manufacture . . . **GEM ELECTRONICS DISTRIBUTORS INC.** has recently opened its doors at 236 Broadway, Hickville, Long Island to handle the distribution of radio, television, and electronic items in the Long Island area . . **THE SOUTHWESTERN COMPANY, INC.,** of Dallas, Texas, has announced a change in the corporate name to **MEDARIS COMPANY, INC.** No other changes in policies, officers, etc., are involved. The company will continue to operate at 1202 Dragon Street, Dallas . . . **TRACERLAB, INC.,** of Boston has announced the consolidation of that firm with **THE KELLEY-KOETT MANUFACTURING COMPANY** of Covington, Ky., and Cincinnati, Ohio. Plans call for the continued operation of both firms under present management.

* * *

W. G. MANY, who for the past twelve years has been advertising and sales promotion manager of the *Cornell-Dubilier Corporation,* of South Plainfield, New Jersey and editor of the company's "C-D Capacitor" has resigned from his post to serve as a public relations counsellor.

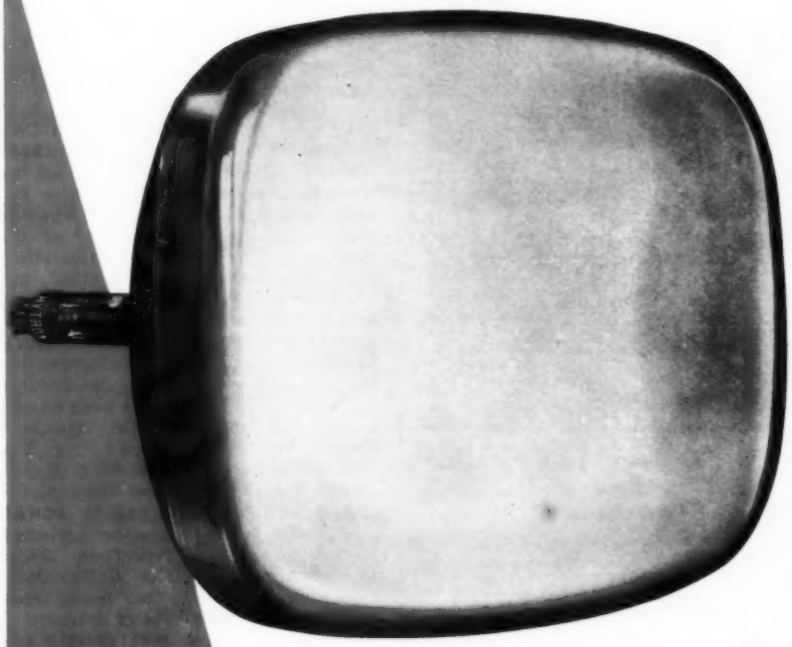
He will conduct a personalized public relations service handling sales and engineering catalogues, literature, house organs, publicity, advertising, and other related promotion activities for electronic and photographic equipment manufacturers.

For the time being Mr. Many is headquartering at his home in Metuchen, New Jersey until suitable facilities can be located elsewhere.

* * *

R. O. BULLARD has been appointed manager of manufacturing of the *General Electric Tube Divisions* . . . **CHARLES A. NICHOLS** has been promoted to the newly-created post of director of engineering for *Packard-*

NEW ELECTROSTATIC RECTANGULAR 20FP4



ANOTHER *HYTRON FIRST* FOR YOU

To its logically designed original *studio-matched* rectangular, Hytron now adds new advantages: the cobalt-and-copper savings of electrostatic focus.

The original Hytron electrostatic type 20FP4 eliminates the magnetic focus unit. Uses a single-field ion-trap magnet. Yet the 20FP4 gives you unsurpassed, clear, sharp pictures . . . despite economies in associated components enforced by defense needs.

Seeing is believing. Watch for this newest Hytron first from the world's most modern picture-tube plant. You'll be seeing it, buying it soon. You'll marvel at its sharp pictures, even at lower line voltages.

Again you'll say it pays to stay out front in picture tubes. It pays to insist on Hytron's original *studio-matched* rectangulars . . . choice of 9 out of 10 leading TV set makers.

HYTRON
RADIO AND ELECTRONICS CORP.

HYTRON RADIO TUBES

MAIN OFFICE: SALEM, MASSACHUSETTS

HAVE YOU GOT YOUR COPY?

The new 5th edition of the Hytron Reference Guide for Miniature Electron Tubes is out. See your Hytron jobber. Get your free copy of this old friend brought up to date today.

Bell while **RICHARD G. LEITNER**, who has rejoined the company after an 18 years' absence, has been named chief research engineer . . . **JAMES B. LINDSAY** has been elected vice-president and director of engineering of *Thomas Electronics, Inc.*, Passaic manufacturer of television tubes . . . **H. H. SCUDDER** and **A. U. PINKNEY** have been named vice-presidents of the *International Standard Electric Corporation* . . . **R. M. BUTLER** has been promoted to the post of assistant sales manager of the merchandise division of *International Resistance Company* of Philadelphia . . . **GEORGE P. ALDRIDGE** is the new vice-president in charge of sales and government contracts for *Radiomarine Corporation of America* . . . **RAY F. CREWS** has been appointed vice-president in charge of sales for the *Fairchild Recording Equipment Corporation* of Whitestone, New York . . . **ED MOREY** has been placed in charge of sales for *Wilcox-Gay Corporation* . . . **GEORGE A. ENGELBERT** has been upped to section chief of the technical publications for *Bendix Radio Division* . . . **WILL BALTIN**, who has served as secretary-treasurer of the Television Broadcasters Association, Inc., from its inception in 1944, has resigned to join *Screen Gems*, the television subsidiary of *Columbia Pictures Corporation* . . . **JEROME TANNENBAUM** has joined *Concord Radio Corporation* as chief engineer of the audio division . . . **HAROLD M. STRAL** has been named advertising manager for *Standard Transformer Corporation* . . . The newly-created post of director of purchases for *Erie Resistor Corporation* is being filled by **GEORGE M. SCHAU** . . . **JOHN S. MILLS** has been elected vice-president of *Tele-Tone Radio Corporation* . . . The *Hallicrafters Company* of Chicago has made three executive appointments of interest to the industry. **R. W. WESTERFIELD** has been named director of procurement. **J. C. MATHEWS** is the new purchasing agent while **ROBERT F. HALLIGAN** will serve as the chief purchasing expediter.

• • •

WILLIAM P. SHORT has been named chief engineer of *General Precision Laboratory* of Pleasantville, New York.

In his new post Mr. Short will supervise production of the company's electronic and optic equipment as developed by the research division.

The new executive, who has been in the electronics field for 22 years, was awarded the Presidential Certificate of Merit for his wartime record as chief engineer of the *Research Construction Company, Inc.* of Cambridge, Mass.

• • •

THE INSULINE CORPORATION OF AMERICA has just opened a third fac-

(*Continued on page* 150)

Floyd Makstein, field engineering manager at ***Emerson*** *recommends*

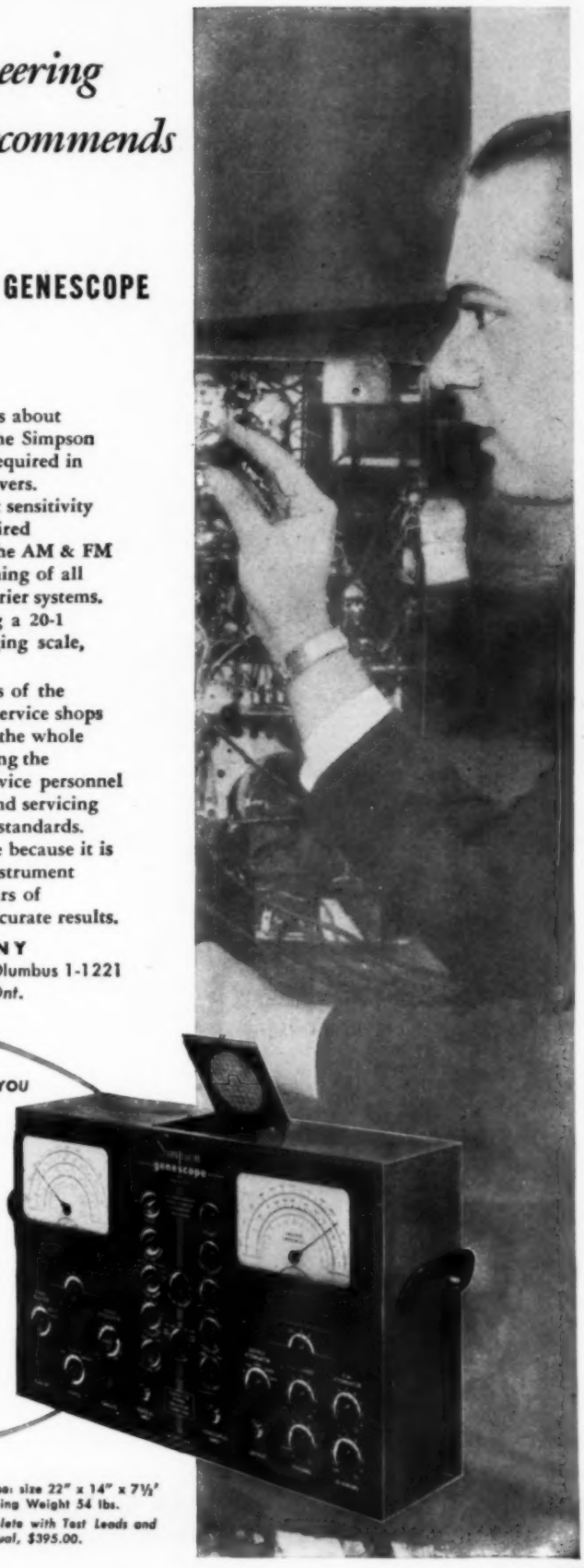
Simpson MODEL 480 GENESCOPE

FOR TV-FM SERVICING

This is what Floyd Makstein of EMERSON says about the Simpson Model 480 Genescope: . . . "The Simpson Model 480 Genescope far surpasses the standards required in the servicing and aligning of all TV-FM receivers. The wide frequency response and the 25 millivolt sensitivity of the oscilloscope, combined with the required fundamental signal sources which are provided in the AM & FM oscillator sections, simplifies the accurate aligning of all TV receivers, including those with intercarrier systems. In addition, the large, easy-to-read dials, having a 20-1 vernier control and 1000 division logging scale, cuts down on servicing time."

Mr. Makstein concludes . . . "The compactness of the complete unit will be a big factor in many of the service shops where space is at a premium. We are sure that the whole TV industry appreciated your efforts in raising the engineering standard in servicing." Emerson Service personnel *know* that modern FM and TV development and servicing demand test equipment made to the most exacting standards. They prefer the Simpson Model 480 Genescope because it is the most accurate, flexible and convenient instrument available. The Genescope will render many years of uninterrupted service and always produce accurate results.

SIMPSON ELECTRIC COMPANY
5200 W. Kinzie St. • Chicago 44, Illinois • Phone: COlumbus 1-1221
In Canada: Bach-Simpson, Ltd., London, Ont.



THESE RANGES SHOW HOW MUCH THE SIMPSON GENESCOPE CAN DO FOR YOU

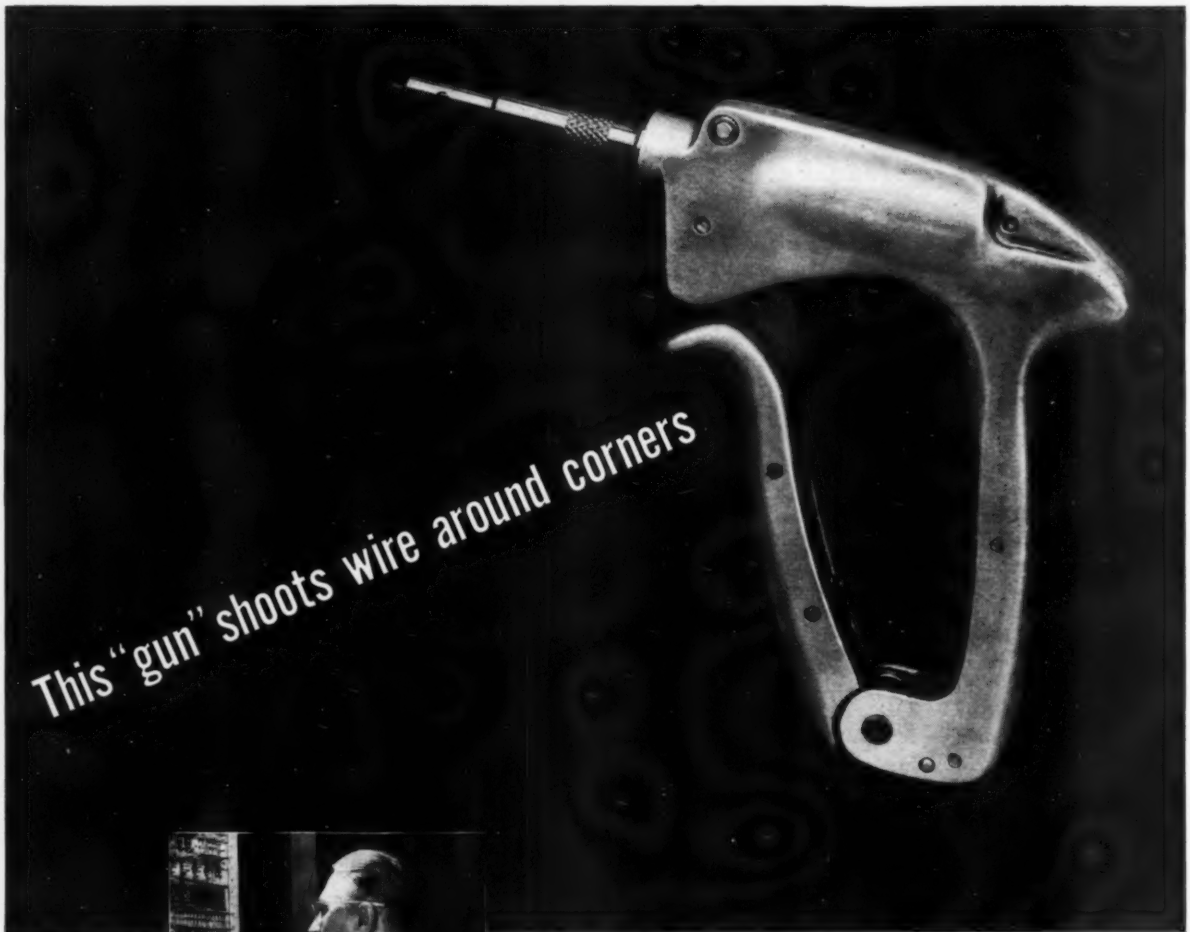
FREQUENCY MODULATED OSCILLATOR
Band A: 2-120 megacycles
Band B: 140-260 megacycles
Sweep width variable from zero to 15 megacycles
Sweep rate 60 cycles per second
Specially designed frequency sweep motor
Continuously variable attenuator
Crystal calibrator: 5 megacycles ± .05%
Audio Oscillator 400 cycles
Output Impedance 75 ohms
Step attenuator for control of output

AMPLITUDE MODULATED OSCILLATOR
Band A: 3.3-15.6 megacycles
Band B: 15-75 megacycles
Band C: 75-250 megacycles
30% modulation at 400 cycles or unmodulated
Continuously variable attenuator
Visual method of beat frequency indication

OSCILLOSCOPE
Vertical sensitivity: 25 mv per inch
Horizontal sensitivity: 70 mv per inch
Linear sweep frequency: 2 cycles to 60 kilocycles
60 cycle sine sweep
Frequency essentially flat to 200 KC. usable to over 3 megacycles

CONSERVE CRITICAL MATERIALS

Simpson Model 480 Genescope: size 22" x 14" x 7½"
Weight 45 lbs. Shipping Weight 54 lbs.
DEALER'S NET PRICE complete with Test Leads and Operator's Manual, $395.00.



Bell Telephone Company craftsman wraps a wire to complete a connection. Wire is inserted into the nozzle and a rotating spindle whips it around terminals.

Close-up of connection made with new tool—neat, tight windings.

IT DOESN'T take long to wrap a wire around a terminal and snip off the end. But *hundreds of millions* of such connections are being made each year to keep up with America's growing demand for telephone service.

Now this job is done much more efficiently with a new wire wrapping tool invented at Bell Telephone Laboratories. This "gun" whirls wire tightly around terminals before solder is applied. The connection is better and there is no excess wire to be clipped off — perhaps to drop among a maze of connections and cause trouble later.

The new tool is being developed in different forms for specialized uses. The hand-operated wrapper in the illustration is for the telephone man's tool kit. Power-driven wrappers developed by Western Electric, manufacturing unit of the Bell System, are speeding the production of telephone equipment. The gun's small nozzle reaches where fingers couldn't — a big advantage these days when efforts are being made to produce telephone system parts smaller as well as better.

Bell Telephone Laboratories scientists devise many special tools that help your telephone system to keep pace with service demands economically — keeping your telephone service one of today's best bargains.

BELL TELEPHONE LABORATORIES

WORKING CONTINUALLY TO KEEP YOUR TELEPHONE SERVICE BIG IN VALUE AND LOW IN COST

MODEL HIR TENNA-ROTOR is the only fully automatic rotator. Just set it and forget it. Your antenna turns to the proper position and stops. North—East—South—West—direction indicator dial shows exact antenna position at all times. Extremely accurate!

THIS NEW TV BOOSTER features one simple control. Automatic on-off switch gives maximum, uniform high gain on all channels—quick to install. An excellent companion item to the Tenna-Rotor. The New Alliance Tenna-Scope!

NATION-WIDE TV ADVERTISING PRE-SELLS! Tenna-Rotor is the only TV accessory backed by a powerful, sustained television campaign—national in scope. Alliance Tenna-Rotor offers faster installation with 4-conductor "Zip" cable. Works in any weather. 1-year guarantee. U. L. approved.

ALLIANCE MANUFACTURING COMPANY · Alliance, Ohio

"OUR CALL-BACK EXPENSE SCARED US!"

"Customers' sets kept giving us trouble. That was before we standardized on quality tubes . . . G-E tubes!"

Says

MIKE FILDERMAN, *Vice-President*
Phillips Radio Company
2012 Shannon Place, S. E.
Washington, D. C.

"Today we don't worry, as we did once, about call-back expense endangering profits. Quality tubes, which we use 100 percent, have done away with our most common cause of receiver trouble—tube failures. When our men finish one service job, they can go on to another knowing it's unlikely the first customer will ask for a return visit. Believe me, that saves plenty when you're servicing TV sets on yearly contract—and Phillips has about 15,000 contracts in the Washington, D. C., area . . . Quality and G-E mean the same thing to us! We feature G-E tubes; we find they keep our call-backs down, our men productive, our profits up."

It's a habit with customers, to ask to see the G-E label on tube cartons . . . so Phillips Radio and other service dealers have discovered. No name excels General Electric in public acceptance—means more quality-wise, builds greater user confidence.

Every G-E picture tube is carefully tested for electrical and screen characteristics. Here brightness is being measured, and the screen area inspected for any blemishes. Many other tests follow. G-E tubes are *pre-checked* for superior performance!

FOR QUALITY TUBES TO CUT DOWN YOUR CALL-BACKS, SEE YOUR G-E TUBE DISTRIBUTOR!

GENERAL ELECTRIC

181-KA5

NAVAL RESERVE Offers New Electronic Training OPPORTUNITIES

T. C. Kuberski and W. G. Dewell inspect an electronic depth finder at a Naval and Marine Corps Reserve Training Center in Texas.

By
COMMANDER
E. L. BATTEY
Assistant Naval Reserve Liaison Officer
Naval Communications Division

Thousands of men in over 800 communities are acquiring new radio skills under the Navy's reorganized Reserve training setup.

THERE are no raised eyebrows or questioning glances when a group of sailors enters the County Jail at Angleton, Texas every Tuesday night. The citizens of that southern Texas city realize that in this case "stone walls do not a prison make." Naval Reserve Electronics Platoon 8-30 has its quarters in the County Jail and the sailors are gathering to attend the weekly instructional period.

Like the group in Angleton, communications and electronics enthusiasts in some 800 cities and towns throughout the United States assemble each week to receive training as members of the Naval Reserve. They don't all meet in jails, of course. A large percentage use the facilities of Naval Reserve Training Centers. In areas where training centers are not available, local civic authorities and private citizens have cooperated in providing meeting places, under permit or lease arrangements with the Navy.

Procurement of suitable quarters for the electronics and communication equipment supplies has been a problem in this era of housing shortages. Quarters used by electronics units, apart from training centers, are designated Naval Reserve Electronics Facilities or Naval Reserve Electronics Stations, depending on the size of the installation and the number of personnel to be trained. Facilities and Stations are found at colleges, universities, elementary schools, high schools, city halls, fire houses, post offices, police stations, federal buildings, airports, hospitals, and in a variety of private structures, including almost everything from hardware stores to bank buildings, and even a casket factory.

The purpose of the Naval Reserve is to provide a force of qualified officers and enlisted personnel who are available for mobilization in the event of a national emergency. The Naval Reserve Electronics Program is designed to meet this requirement in the case of operational and technical electronics personnel. Inaugurated in 1946, and reorganized in 1950, the Electronics Program includes one-third of all personnel in Organized Reserve units at Naval Reserve Training Centers, in addition to the many hundreds of persons associated with Companies and Platoons at Naval Reserve Electronics Facilities and Stations. The Electronics Program is the most extensive single program in the postwar Naval Reserve. The prewar counterpart of the Electronics Program was the Naval Communication Reserve, organized in 1925. The Communication Reserve was primarily a training ground for "communicators"—radiomen, signalmen, and communication officers. Instruction in radio theory and equipment was limited. There were no Electronics Technicians in the Navy in the days of the Communication Reserve. The war-born impetus accorded to the field of electronics has been recognized realistically in the new Naval Reserve by increased emphasis on training in both the operational and technical phases of electronics equipment.

"Electronics" Defined

The term "electronics" as used in the Naval Reserve Electronics Program is an all-inclusive term covering the many aspects of both technical electronics (maintenance and repair of equipment) and operational electronics (use of equipment). Persons in this program are called "electronics personnel," whether in training as electronics technicians or as radiomen. The Electronics Program, of course, embraces many additional ratings, as for example, Radarman, Sonarman, Quartermaster, Fire Control Technician, and Interior Communication Electrician. Officers associated with Electronics units are for the most part specialists interested in one or more of the broad fields of

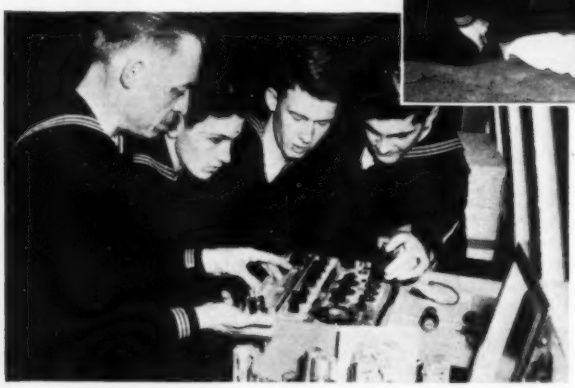
communications, technical electronics, combat information center, or anti-submarine warfare.

Organization

Electronics personnel is assigned to Organized Surface and Submarine Divisions of the Naval Reserve for training, utilizing facilities installed for this purpose at the Naval Reserve Training Centers. One or more of the Divisions training at each Training Center has electronics personnel assigned. In addition, electronics personnel is assigned to Organized Electronics Companies, Volunteer Electronics Companies, and Volunteer Electronics Platoons. Except for the provision that Organized Companies must meet special personnel requirements and the fact that their members receive drill pay, there is no essential difference between an Organized Company and a Volunteer Company. Each is usually quartered at a Naval Reserve Electronics Facility and the available equipment is utilized equally by both. Volunteer Electronics Platoons, whose personnel allowance is smaller than that authorized for Companies, utilize the facilities of Naval Reserve Electronics Stations. Stations differ from Facilities only in space requirements and amount of equipment furnished. When Volunteer Companies and Platoons are organized in the immediate vicinity of a training center, they use the training center facilities. Organized Companies are not authorized in locations where Organized Surface, Submarine, or Air units are established.

One view of the Electronics Laboratory at the Naval Reserve Training Center in Charleston, South Carolina. Commander V. H. Conradt-Eberlin, district reserve electronics program officer; Lt. Commander E. E. Stephens, inspector-instructor; and C. J. Walker, radioman 2nd class, watch as Colon Baxley works on a chassis in lab.

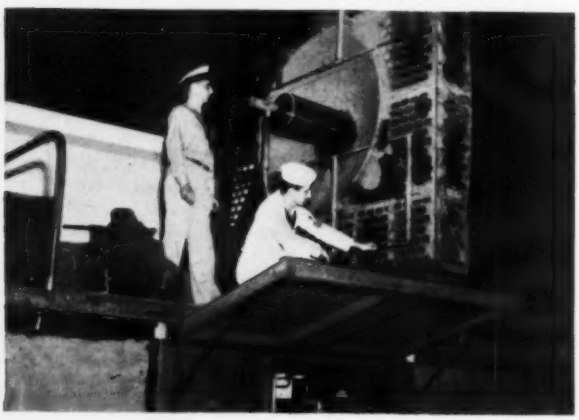
Antenna atop the Printcraft Bldg. in Washington, home of Naval Reserve Electronics Companies W1 and W8 and amateur station W3PZA. J. M. Becker, chief radioman, USN, and Allan R. Richter, W4PHL, of the Red Cross consult on transmitting problems.



F. A. Liberte gets some pointers from Chief Electronics Technician Willis L. Smith on troubleshooting a radio transmitter unit.

Electronics Technician 2nd Class E. A. Brule demonstrates the proper use of a tube checker to naval electronic technicians.

Members of the Organized Surface Division 8-73 at the Naval and Marine Corps Reserve Training Center in Corpus Christi, Texas assist in the conversion of an Army radar unit to a hurricane warning radar unit. This instrument, which is the property of the A & I College in Kingsville, Texas, is being maintained by the Central Power and Light Company and is in operation at the Clift Maus Airport in Corpus Christi, Texas.



Widespread Facilities

There are 315 Naval Reserve Training Centers now equipped and operating. Quotas assigned to Naval Districts provide for 500 Naval Reserve Electronics Facilities and 750 Naval Reserve Electronics Stations. Actual establishment is effected as training needs dictate. Certain minimum personnel requirements govern the activation of Companies and Platoons, for which Facilities and Stations are furnished. Approximately 500 Facilities and Stations have been established to date.

Equipment

Each of the Naval Reserve Training Centers has a complete electronics installation, which includes an electronics laboratory, complete with test and measurement instruments, and radio, radar and sonar equipment. Each Electronics Facility and Station has a similar set-up, but on a scale in keeping with the smaller number of personnel to

be trained. In addition, each Training Center, Facility, and Station has an operative radio station.

The standard equipment allowance lists include quantities of electronics equipment, completely operable units, as well as component parts for original construction projects. Much modern shipboard equipment is available for realistic training.

The Navy has made a large dollars-and-cents' investment in the training program for Naval Reserve electronics personnel. Actually, the program only starts with the equipment and facilities. What really makes it tick is the personnel, both the members of individual units, and the supporting personnel within the Naval Districts and in the Navy Department in Washington. All officers of the Naval Establishment perform the same duties for the Naval Reserve as they perform for the Regular Navy. To provide further support, the Navy retains on active duty a limited number of Naval Reserve officers and men in billets concerned solely with the administration and training of the Naval Reserve.

Administration

The Chief of Naval Personnel has management control over the organization and training of the Naval Reserve Electronics Program. Commandants of Naval Districts effect administration at district level. Since training is the basic function of the Naval Reserve, the District Director of Training has primary cognizance of the program. Assigned to the office of each Director of Training is a Naval Reserve officer who is responsible for the implementation of the Electronics Program within the district. He is known as the District Reserve Electronics Program Officer (DREPO). Most DREPO's and their assistants are both former members of the prewar Naval Communication Reserve and licensed radio amateurs. All are veterans of World War II. They bring to the Electronics Program many years of experience plus a practical knowledge and understanding of Reserve matters. Working with the DREPO is a Reserve Operational Communication Officer, who is thoroughly familiar with the District Reserve Communication Network and other aspects of training in operational communications. Also assigned to the Director of Training are officers who work on the technical electronics, Combat Information Center, and Anti-Submarine Warfare phases of the Program.

Training

Training of electronics personnel in the Naval Reserve is of two general types, individual and team. Each indivdual is trained in the skills required in his specialty and in the application of those skills while functioning as a member of an integrated operational team. The Chief of Naval Personnel provides curricula for use in the training of each electronics rating and furnishes study and instruction material, including training aids, developed to support the curricula. Correspondence courses in a wide range of general and specialized subjects also are made available to both officers and enlisted personnel for home study.

Team training is associated with three principal operational electronics fields: Communications, Combat Information Center, and Anti-Submarine Warfare. In providing for team training, the Chief of Naval Personnel receives the guidance and assistance of officers within the Office of the Chief of Naval Operations. For example, the Director, Naval Communications, plans for and supervises the Naval Reserve Communication System, which is the principal means for team training in operational communications.

Each Naval District publishes a Naval Reserve Electronics Bulletin for members of the Electronics Program. These Bulletins, which are a valuable adjunct to training, contain timely information on the Electronics Program, items of general interest to Reservists, and useful articles on operational and technical electronics.

Herman E. Parker, ARM1, and W4ODA, tunes up transmitter at the Fifth Naval District Reserve master control station.

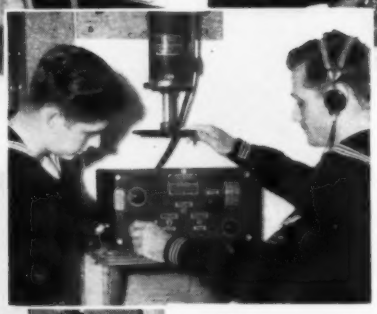
"Radio Central" at the Naval Reserve Training Center in Charleston, S. C. finds W. M. Nolin and J. M. Ward watching W. G. Dunn, J. M. Cowart, and L. B. Williams during a training session. All are members of Electronics Co. 6-1 of Troy, Alabama.

J. L. Fairchild, radioman 2nd class, prepares equipment for code practice transmission from Navy radio station, N1RRF.

Station W5USN, Eighth Naval District Reserve Master Control Station, New Orleans. Left to right are: Commander J. M. McCoy, W5OM; Lt. Commander J. J. Zammit, W5HKP; Chief Radioman F. C. Burt, W5EGX; and Lt. Commander J. P. Foster, W5HNW.

An over-all view of the main radio operating room at the Naval Reserve Training Center located at Albuquerque, New Mex.

Radio code and typewriting class at Pawtucket with Instructors Russell Bates at the key and C. J. St. Andre, W1SGC, watching.



★

←

Robert H. Brown, quartermaster (signalman) second class, instructing Houston Carl! in the operation of a direction finder at Organized Electronics Company 8-3, Waco, Tex.

←

Electronics Technicians C. B. Garcia and J. F. Talerico get practical experience in maintenance and repair of radio receivers.

The gyro room at the Naval Reserve Training Center in Albuquerque, New Mexico showing the Sperry gyro compass and the repeater panel board. Shown in the photograph standing (from l. to r.) are A. Garcia, Lt. E. W. King, and C. R. Stanello. K. E. Langley, seated at controls, demonstrates unit's operation.

The Naval Reserve Electronics Program offers an unusual opportunity to the youth who desires to break into the field of electronics. The well equipped laboratories and systematic instruction schedule combine to provide an interesting introduction to the art. The student starts out with basic electricity and works his way through the standard laboratory experiments to a level of knowledge where he may start an intensive study of radio leading to advanced electronics. The curriculum is so designed that an individual can advance according to his capabilities—he progresses from lesson to lesson just as rapidly as he completes each assignment. His progress is limited only by his ability and willingness to devote time to the study. Completion of required training leads to the rating of Electronics Technician in the Naval Reserve. Electronics Technicians not only perform valuable service to the nation in time of emergency by maintaining and repairing Navy electronics equipment, but their services are constantly sought by private industry during peace time. The knowledge gained through association with the Naval Reserve gives a solid foundation for a career in electronics.

Radio Training Circuits

The Naval Reserve Communication System is composed of radio stations installed at all Training Centers, Electronics Facilities, and Electronics Stations, and the radio stations of certain individual Reservists. In addition, activities and individuals of the Naval Air Reserve, Marine Corps Reserve, and Coast Guard Reserve may participate. In each Naval District, radio stations are assigned to one of several training circuits operating within the District Reserve Communication Network. Each circuit operates on Navy frequencies on a time schedule coinciding with the meeting nights of units served. Thus, personnel receives practical on-the-air training in Navy communication techniques and procedures. The District Network is supervised by the Reserve Operational Communication Officer, with advice and assistance from the District Communication Officer. Training is provided in both manual and automatic methods of communication, including radioteletype where such equipment is installed.

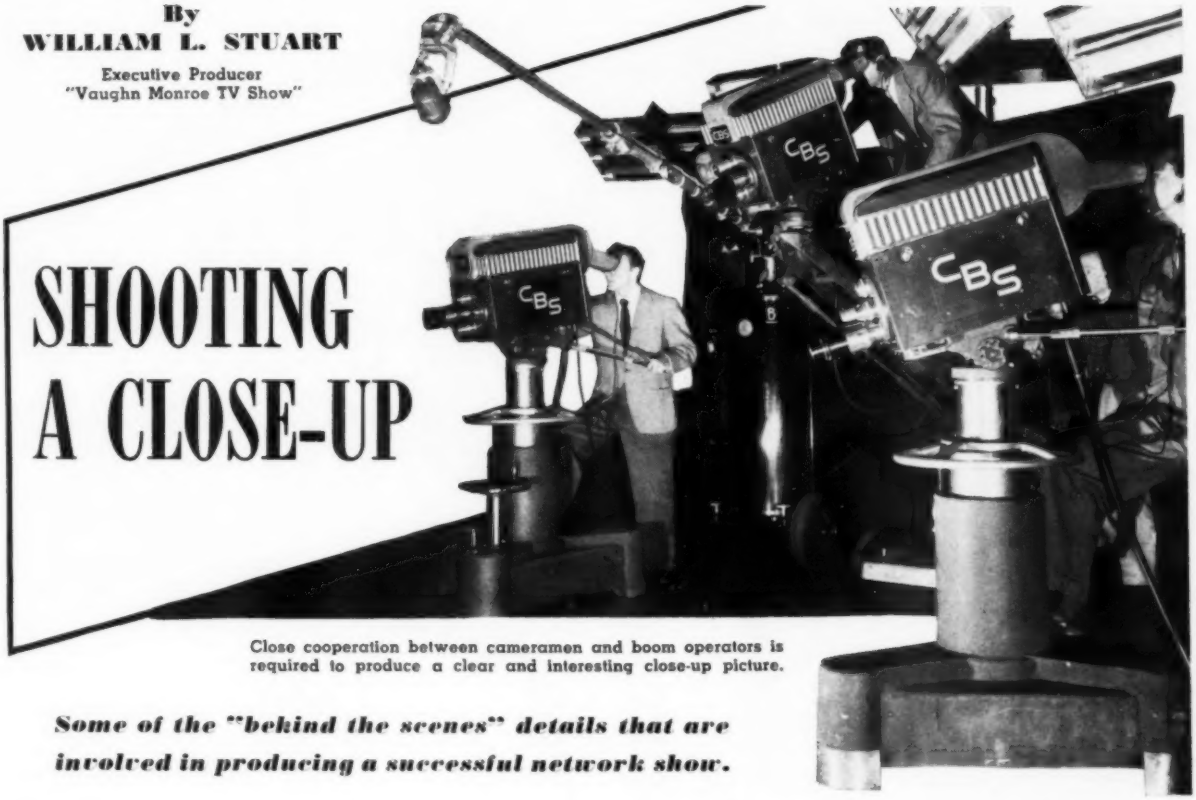
Radioteletype

Radioteletype installations of the most modern design are being completed in 75 Naval Reserve Training

(*Continued on page* 128)

By
WILLIAM L. STUART
Executive Producer
"Vaughn Monroe TV Show"

SHOOTING A CLOSE-UP



Close cooperation between cameramen and boom operators is required to produce a clear and interesting close-up picture.

Some of the "behind the scenes" details that are involved in producing a successful network show.

THERE has come to be, in this world, a species of man (and in a few instances, woman) who sees light only in terms of four rectangles which are approximately as large as a sheet of writing paper.

Three of these rectangles are the monitors which represent the pictures being shown at the moment in the three cameras which photograph a television show. The fourth represents the picture being sent over the air. The men (or an occasional gal) in question, are television directors, seated deep in a darkened room. Should they ever achieve any degree of suntan, it can only be because the monitors they look at have been miraculously hooked up with an ultra-violet lamp.

To get the feeling of a television control room, it is necessary to describe one. It operates, in most instances, on two levels. On the upper level sits the director, the man who runs the show. Don Appell, our director, who also conceives and stages each program, is flanked by the assistant director on his right, and by the technical supervisor and audio man on his left. On the level below are the technical men and their monitors. Each of the monitors is an "eye" which looks through a camera into the studio. Unwinkingly, they record what each of the three cameras we use is doing at each instant throughout the show. It is the director's duty to choose, at exactly the right instant, which of these three pictures shall be shown to the public, and in what order they shall be shown.

This may sound hit or miss. It is not.

It is generally assumed that fifty hours comprises a fairly heavy work week. The work week on the Vaughn Monroe Show consists of about 90 hours in production and direction; and those hours are required to make sure that the three "evil eyes" of the monitors will be showing exactly the pictures wanted at the time they are wanted.

Some twenty-two to twenty-four hours of rehearsal goes into each show. But before that can happen, these things must be done:

(1) The music, selected by polling service camps throughout the country, must be rated.

(2) The pop tunes, as selected, must be fitted into a show.

(3) The numbers must be staged individually.

(4) The scenic designer must develop the setting for the program.

(5) The costumer and property men must shop to costume and dress the show.

(6) The lighting man must determine how the program is going to be lighted.

(7) The musical director and his staff of arrangers must provide orchestrations for all the instruments in the band.

To produce the pictures that appear on the three monitors in the control room, approximately 125 people spend an entire week readying the various elements needed. Having done that, it

(*Continued on page* 132)

One of the television control boards at CBS showing the monitor screens.

CONVERTING THE G-E MODEL 811*

The G-E Model 811 before conversion.

By
ROLAND KEMPTON
Editor, "Techni-talk"

Details for converting an early model 10" television receiver to either 12" or 16" operation. Cabinet is big enough to accommodate larger size picture tube.

IN THE past many technicians have avoided small-screen conversion jobs as being time-consuming, low-profit service work. Even in cases where the service dealer was willing to take on such jobs, he made no particular effort to secure a volume of this type of work.

The reasons behind this disinterest ranged from a lack of suitable woodworking tools and skilled help to the lack of "know-how" for making such conversions. If television production is cut to any appreciable extent, technicians will find that requests for conversion jobs will increase and, happily, will afford a fairly painless way of increasing their shop incomes.

Such conversions are now relatively easy because the new rectangular filter-face or aluminized picture tubes can be used without any need to replace the receiver cabinet.

In this and in subsequent issues we will present data for converting several popular receivers, according to instructions drawn up by *General Electric* engineers. The first receiver to be covered is the *General Electric* Model 811. This popular console model is shown before conversion in Fig. 1 and after conversion in Fig. 2. The entire receiver should be brought into the shop for this conversion job. The cabinet is big enough to accommodate either a 12 inch round or a fourteen, sixteen, or seventeen inch rectangular picture tube. Due to the relatively little difference between the "expanded" 12 inch mask and the rectangular 14 inch mask, as shown in Fig. 3, it is both cheaper and easier to convert this particular model to accommodate the 12 inch 12LP4A round tube instead of the 14 inch 14CP4 rectanglar tube. This is because the deflection angle of the 14CP4 is 70 degrees whereas the 12LP4A is the same as the 10BP4 tube originally used in this receiver. Whenever a 70 degree picture tube is used to replace a 50 degree picture tube the yoke must be replaced as otherwise neck shadows cannot be eliminated.

The conversion described in this article is a procedure which produced satisfactory results with respect to a General Electric Model 811. If a conversion is attempted on a similar model of an earlier or later date or on a different model from the same manufacturer, then additional adjustments and steps may be necessary. The changes which were made have not been approved by the manufacturer and may, therefore, invalidate the manufacturer's warranty.

It is suggested that the electrical changes be made first and then the cabinet changes whenever a conversion is made on an unfamiliar model. In this way if any difficulty is experienced which might make the conversion impractical, the electrical changes can be returned to their original state. It would be considerably more difficult, however, to return the cabinet to its former condition.

Except for the standard equipment available in most service shops, very few additional tools are required in making conversions and most of these units are needed for the cabinet work. Such "extra" equipment includes a hack saw, a keyhole saw, a half-round bastard file, a wood chisel, plastic wood, a ½" hand or electric drill, a hand or electric jig saw, a bottle of dark walnut stain, adhesive rubber cushion (½" wide), jig saw blades for plastic, metal, and wood, resistance boxes, capacitance boxes, etc.

Twelve-Inch Changes

The chassis of the Model 811 should be removed to the service bench and the following changes made.

Disconnect the white lead of the horizontal size control (L_{18}) where it connects to pins #4 and #6 of V_{18}. Tape this end using high voltage insulating tape.

Next short out the series coil of the size control by shunting R_{84} with a jumper wire.

Now connect a .25 μfd., 600 v. con-

* These conversion notes originally appeared in the October-November 1950 issue of "Techni-talk" published by General Electric Tube Divs.

denser across C_{58} in the 5V4G cathode circuit.

Finally connect a 500 μμfd., 1000 v. condenser across the secondary of T_{17} or across the horizontal deflection coils whichever is easier to locate. Assemble and connect the yoke, focus coil, socket, etc. onto the 12LP4A and observe a test pattern. Adjust the horizontal linearity, height, vertical linearity, and focus controls for the best test pattern. If the focus control range is insufficient, short out the 560 ohm resistor (R_{70}) which is in series with the focus control, R_{72}.

If the width is insufficient increase the 500 μμfd. capacitance across the horizontal deflection coils and if too wide reduce this same capacitance. The vertical linearity may require some correction which can be made by shunting R_{39} in the plate circuit of the 6SN7GT vertical sweep generator tube with a 4.7 megohm resistor. The vertical linearity and height controls must then be readjusted.

Sixteen-Inch Changes

If this receiver is to be converted to use either a 16KP4 or 17BP4A rectangular tube, the following additional components are required. The parts numbers listed are all *G-E* replacement numbers: One RTO-085 horizontal sweep transformer, one RLD-024 deflection yoke, one RLF-038 focus coil, and one RET-003 ion trap magnet.

The following changes should then be made in the horizontal output circuit, as shown in Fig. 5.

Disconnect leads of original sweep output transformer, including filament loop for 1B3GT tube. Mount new transformer on chassis and wire into circuit.

Disconnect the white lead of the horizontal size control (L_{18}) where it connects to pins #4 and #6 of V_{15} and

(*Continued on page* 100)

Fig. 1. Front view of the General Electric Model 811 with the original 10" CR tube.

Fig. 2. Same receiver converted to accommodate the 16-inch rectangular picture tube.

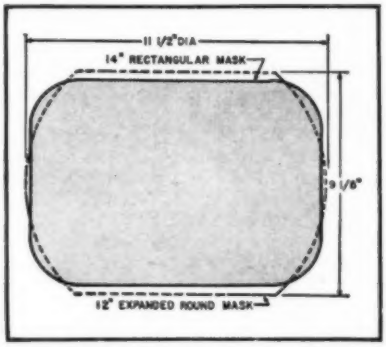


Fig. 3. Area of a 12-inch "expanded" mask compared with a 14-inch rectangular mask.

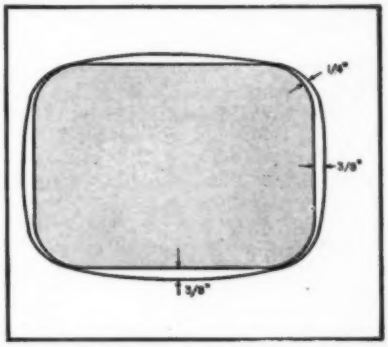
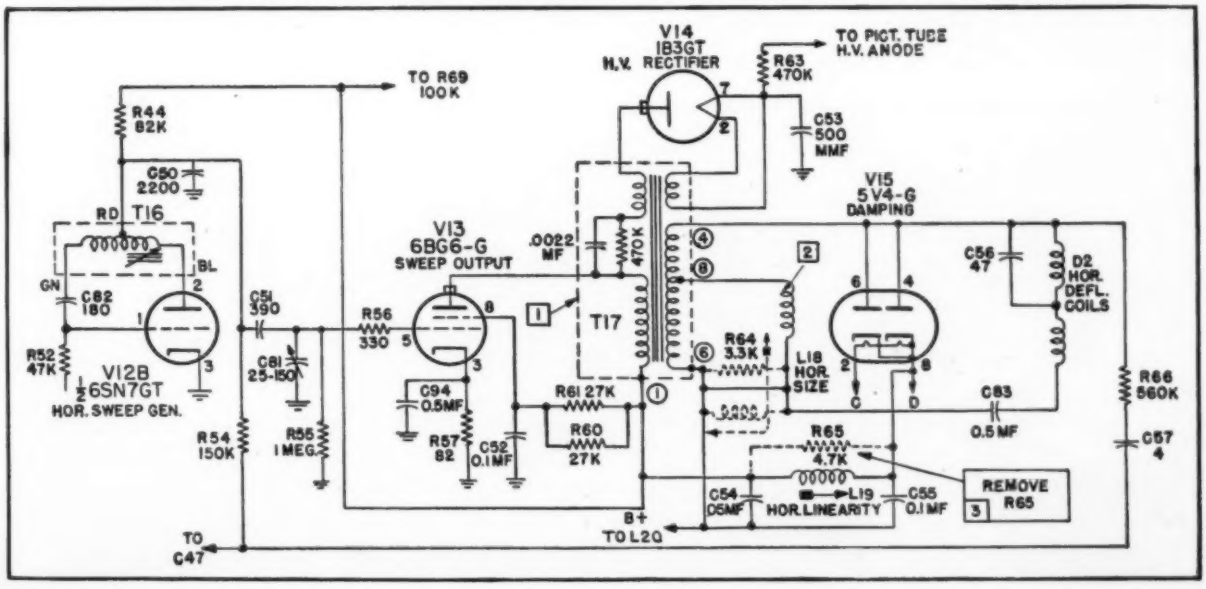


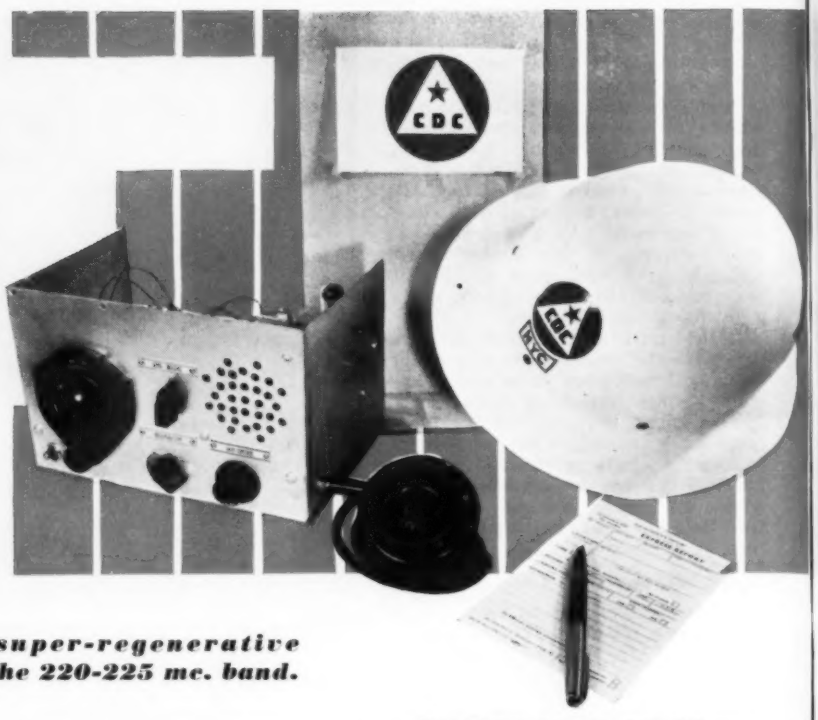
Fig. 4. Useful screen area of 16KP4 picture tube compared with 17BP4A picture tube.

Fig. 5. Horizontal output circuit of the General Electric Model 811 after conversion to use a 16KP4 rectangular picture tube.



A Civilian DEFENSE STATION

By
FRANK HEUBNER



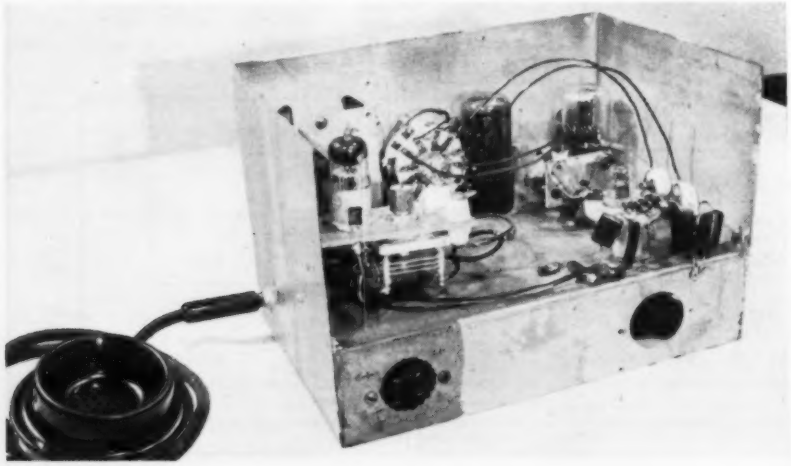
Over-all view of station. Helmet shows comparative size of this compact unit.

Construction details on a super-regenerative type transceiver covering the 220-225 mc. band.

SINCE the Federal Communication Commission has now designated the frequencies for use by Civilian Defense Stations, we can make our final plans accordingly. In these plans we should consider making the most use of the frequencies assigned us so as to cause ourselves the least QRM. The lower frequencies would normally be used for the longer haul city-to-city services, while the higher frequencies with greater frequency allocation should be used for the short haul local services. This type of planning puts the small local incidents on one band and the large incidents, where other city help is required, on a lower frequency band. There is another good reason for this type of planning. The recently approved Technician Class amateur license will open up a new field for obtaining operators which are urgently needed in Civilian Defense especially as more of the younger hams are drafted. A Technician Class license is only valid on the highest band assigned for Civilian Defense Service, namely, 220 to 225 mc.

In the average small town the maximum distance from any point in town to its centrally located Civilian Defense Center is 5 miles. In the larger cities the local Police Precincts are the Civilian Defense Centers which control their local areas and they are centrally located within 5 miles of any point under their jurisdiction. The problem therefore resolves itself into providing reliable two-way radio transmission for this distance at the minimum expense. The basic station design should be such that it can be used in a Civilian Defense Center, hospital, school, fire station, police station, an automobile, or as a "walkie-talkie" field set. It should be so designed that it will work on the regular 115 volt a.c. supply, on a 6 volt automobile battery, or entirely on dry batteries without excessive battery drain.

Rear view of transceiver. A single button carbon type microphone is used.



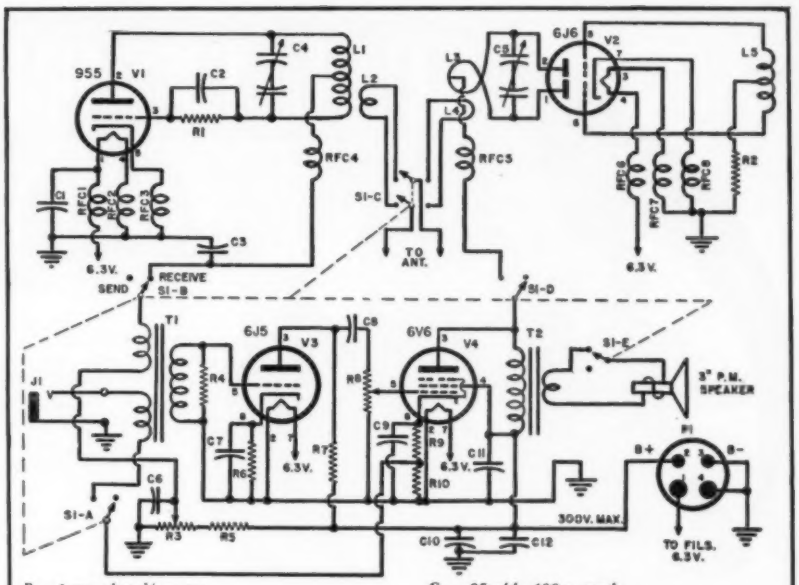
It is felt that this 220-225 mc. station to be described herein covers the specifications. The equipment is small (6" x 6" x 9") and if placed in a cabinet is readily portable. Tests were conducted on this station in Glen Ridge, N. J. by the Civilian Defense Radio Group. The tests proved so satisfactory that they are now planning five more of these stations to equip a hospital, three schools, and a police headquarters. When additional funds become available a second transmitter and receiver for the Control Center will be installed on the 145.5 mc. band. This will permit communications with the New Jersey State Control and other mutual aid cities.

The basic design of the station is not new. It consists of a modulated oscillator as the transmitter and a superregenerative receiver. The audio system of the receiver is also used as the modulator for economic reasons. With a 300 volt power supply the transmitter gives out about 2 watts of carrier. The current drain at this voltage is 70 ma. for transmitting and 39 ma. for receiving. For portable use with 135 volts of dry batteries the drain is reduced to 17 ma. for transmitting and 13 ma. for receiving. With either of these voltages transmission over 5 miles can be made without any

difficulty. Radiation trouble from the superregenerative receiver has been held to the minimum by the use of an acorn 955 tube which, if in good condition, requires only 15 to 20 volts of "B" voltage for proper operation. On nearby stations the antenna coupling may be made very loose which reduces the radiation still more.

This station is not difficult to build and get into operation. Most of the constructional details are apparent from the photographs. The model shown was built from galvanized sheet iron by bending the two sides and front panel from one sheet 6" x 21" long. A 2" high chassis was bent from another sheet and soldered in place. A standard aluminum chassis 2" x 7" x 9" would be just as good. In the front view photograph the receiver tuning dial is on the left, with the "Send-Receive" switch in the center and the regeneration control below it. On the extreme upper right is the PM speaker with the gain control directly under it. The "On-Off" toggle switch in the lower left hand corner may be used to turn on the 115 volt power supply. On the left hand side the two feedthrough insulators are for connecting the antenna. The microphone jack is installed on the lower right hand side of the chassis. The microphone used is a single button carbon type, known in the surplus market as an F1 unit.

In the photograph of the the rear view, the transmitter is on the left hand side in the rear. It was constructed on a small angle piece of aluminum 3/16" thick which is fastened to the side. The 6J6 socket should be mounted adjacent to the butterfly condenser so that the two plate connections will be as short as possible. The 955 detector with its associated coil and condenser are shown at the right rear. A lucite or bakelite ¼" diameter shaft with a flexible coupling connects the condenser rotor with the front panel dial. On both sides of this shaft adjacent to the front panel are the audio and modulator tubes 6J5 and 6V6. The variable condenser used here was



R_1—1 megohm, ½ w. res.
R_2—10,000 ohm, ½ w. res.
R_3—25,000 ohm, 2 w. pot.
R_4—200,000 ohm, ½ w. res.
R_5—50,000 ohm, 1 w. res.
R_6—2200 ohm, 1 w. res.
R_7—100,000 ohm, 1 w. res.
R_8—500,000 ohm vol. control
R_9—500 ohm, 1 w. res.
R_{10}—200 ohm, 1 w. res.
C_1—100 μμfd. mica cond.
C_2—50 μμfd. mica cond.
C_3—.006 μfd. mica cond.
C_4—Modified var. cond. (Cardwell "Trim-Air" —see text)
C_5—Butterfly cond., 3-rotors, 3-stators, 7 μμfd. max. (Hammarlund)
C_6—.25 μfd. paper cond.
C_7, C_{11}—25 μfd., 50 v. elec. cond.
C_8—.05 μfd., 400 v. cond.
C_{10}—.001 μfd. mica cond.
C_{11}—.01 μfd., 400 v. cond.
C_{12}—8 μfd., 400 v. elec. cond.
RFC_1, RFC_2, RFC_3, RFC_7—20 t. #18 en. air-core ⅛" dia.
RFC_4, RFC_5—25 t. #28 d.c.c., air-core ⅛" dia.
RFC_6, RFC_8—30 t. #28 d.c.c., air-core ⅛" dia.
T_1—Transceiver trans. (Thordarson T72A59)
T_2—Output trans. 5000 ohm to v.c.
S_1—6-pole d.t. ceramic wafer sw.
J_1—Phone jack
P_1—4-prong plug
Spkr.—3" PM speaker
L_1—6 t. #12 bare, air-core ¼" dia.
L_2—2 t. #20 hook-up wire, air-core ¼" dia.
L_3—1 t. #12 bare, air-core ¾" dia.
L_4—¾" dia. loop of #20 hook-up wire
L_5—3 t. #18 bare, air-core ⅜" dia.

Complete circuit diagram of transceiver. Coils and chokes must be hand wound.

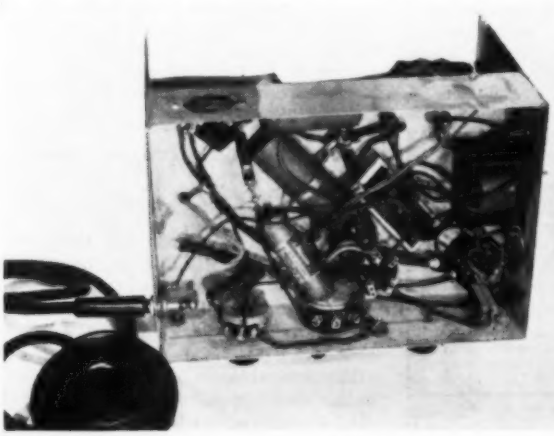
a *Cardwell*. The stator plate on this model can be removed by loosening the two nuts. This plate is then sawed through the middle between the two mounting holes. The condenser is then reassembled using one post for the grid end and the other post as the plate end of the tank coil. The rotor should be free and not grounded. About 1/16" spacing should be used between the rotor and stator. If this gives insufficient bandspread change the distance to 3/32". The socket in the rear of the chassis is for connecting the 6.3 volt filament and 300 volt power supply voltages.

The underneath view shows the transceiver transformer mounted toward the rear right. The rest of the resistors and condensers may be mounted at random.

The circuit diagram includes the various coil sizes and these together

(*Continued on page* 119)

Bottom view of transceiver. Unit will operate direct from batteries or from either a vibrator or a 115 v. type power supply.



Top view of transceiver. Toggle switch, not included in schematic, shown on front panel is connected in power supply circuit.

QUALITY AMPLIFIER for TV SOUND

Construction details on a compact and inexpensive replacement unit which can be built at an approximate cost of $10.

Over-all view of the audio amplifier. This unit delivers 3 watts at .5 per-cent total measured distortion and is flat within ½ db. from 20 to 20,000 cycles. Input is just 1 volt.

By
LAWRENCE FLEMING

THE reproduction of a television sound channel requires a little different treatment than other radio and phonograph sources. The difference in the TV sound is that its inherent quality is generally excellent and the background noise level very low, but that listening is done at a comparatively low level. While a good audio amplifier of, say, 12 watts' rating will work fine with a TV receiver, it will be many times larger and more complicated than necessary and may pose a space problem. In TV, sound is subordinate to the picture. Too high a sound level distracts attention from the picture and seems out of balance. At the same time, noisy or distorted sound induces fatigue, and is ruinous to the enjoyment of the show. What is needed is very clean, quiet reproduction with clear, crisp "highs."

It is usually best, to preserve the illusion, to locate the speaker close to the viewing screen even at the expense of having to use a smaller speaker. In a speaker for this use, freedom from sharp peaks in the response is more important than wide range, and 8-inch units are usually smoother than larger cones. The writer uses a *Western Electric* 755A speaker located in the regular television console, driven by the 3-watt triode amplifier to be described. This amplifier delivers 3 watts at 0.5 per-cent total measured distortion, and measures flat within ½ db. from 20 to 20,000 cycles. The input voltage required for 3 watts output is one volt.

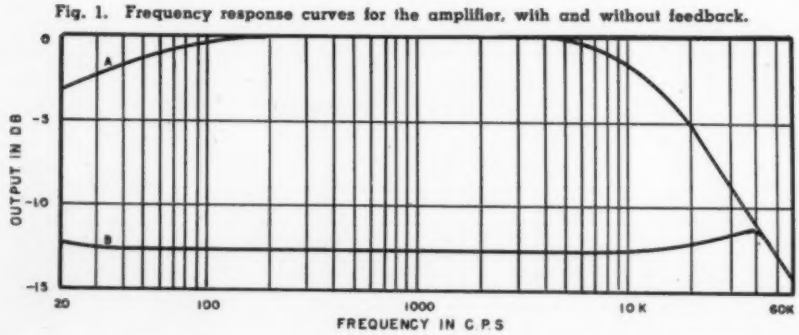
This amplifier is pint-sized physically, built on a 7" by 7" chassis without crowding. Standard replacement-type radio parts are used throughout. The cost of all the components should not be much over ten dollars. The output transformer is a *Stancor* type A-3830, a "universal replacement" type rated nominally at twenty watts and weighing two pounds. Used so far under rating, this unit will deliver 4 watts at 70 cycles and about 2 watts at 40 cycles before core-saturation distortion becomes noticeable.

Actually an amplifier of this sort is so far superior to that built into most radio and TV sets that its incorporation into any ordinary console will make a vast difference in the audio quality. The 3 or 4 watts is more than adequate power for any living room, except perhaps for addicts of ear-splitting volume.

The writer's aim was to make a good self-contained audio unit which would fit into spare cabinet space, and would replace the audio channel originally in the set. The amplifier has its own power supply, so that the only connections required to the receiver are input, speaker, and 117 volts a.c. No tone controls are included, since these properly belong outside the feedback loop and on the tuner chassis, available to the panel. A considerable effort was made to achieve the lowest weight, size, and cost commensurate with the best performance.

Fig. 1 shows the frequency response and Fig. 2 the total harmonic distortion *versus* output power. In Fig. 1, curve *A* gives the measured response before the negative feedback was applied. It is down 1 db. at 60 and 8000 cycles, due principally to the output transformer, although some of the high-frequency droop is traceable to the high-mu triode amplifier stage. Curve *B* is the response with feedback. Although only 12.5 db. of feedback is used, it flattens out the curve more than adequately. The only departure from a straight line is now the 1.5 db. peak at 40 kc. Above 40 kc. the two curves run together. Both curves were plotted with the same input (.093 volt), so that the difference in db. between the two is the actual amount of feedback existing at that frequency. Thus, at 20 cycles there is 9.5 db. of feedback, and at 40 kc. and above there is none. Through the audible range there is plenty of feedback, since no shunt condensers are used across any stage.

Fig. 1. Frequency response curves for the amplifier, with and without feedback.



Distortion was measured at 80 and 400 cycles, across the output transformer secondary into a 4-ohm resistive load. The results were the same at both frequencies, and the total harmonic content at various power levels is shown in the curve of Fig. 2. The distortion rises slowly from about 0.2 per-cent at one watt output to half a per-cent at 3 watts. If one were to promote such an amplifier commercially, he might rate it at 4.5 watts, since this is where the 5 per-cent distortion level is reached. However, let us be conservative and call this a 3-watt amplifier, or, if 2.5 per-cent distortion is not too much, a 4-watt job.

The plate input to the power stage is about 14 watts, so that the efficiency at 4 watts output is 28.5 per-cent. This is not bad for class A triodes including the output transformer, and in fact indicates that the insertion loss of the output transformer that was used is unusually low.

A check of distortion was made at 40 cycles and it was found that the output transformer overloaded at 2.5 watts, but that at 2 watts the distortion was only about 1.5 per-cent. This is mainly of academic interest since the speaker used cuts off at 70 cycles. However, to avoid intermodulation troubles from unheard low frequencies, it might be well to provide some low-frequency cut ahead of the input.

Damping and Hum

Connecting a 4-ohm resistor across the secondary terminals dropped the voltage 10 per-cent from the open-circuit value. Thus, the output impedance is 0.4 ohm on the 4-ohm tap, and the speaker damping factor is 10.

The hum voltage at the voice terminals measured 1.5 millivolts (about ½ microwatt), or 66 db. below 3 watts. While this level is inaudible, it is worth noting that most of this hum is inductive pickup by the output transformer from the power transformer, and that it is well to orient these two components so that their coils are at right angles.

The circuit, shown in Fig. 3, is about as simple and straightforward as can be, but is the result of considerable experimentation. The output stage is a pair of 6AQ5 miniature beam tubes, triode-connected, in push-pull, with 300 volts on the plates. The tube complement is completed by a single high-mu twin triode as the voltage amplifier and phase inverter.

In its use of triodes at comparatively high plate voltage, this circuit may be considered a smallish cousin of the *Williamson* amplifier. It is also based on a very low-distortion 6L6 circuit designed some years ago by the West Coast audio engineer, Dunford Kelly.

A survey of the triode characteristics of various small power tubes showed, rather surprisingly, that the 6V6 was far and away the best. Its miniature counterpart, the 6AQ5, has the same properties. Table 1 gives the pertinent data for these tubes, calculated from published curves and checked by experiment. Due to their rather high mu (9), the efficiency drops rapidly below about 300 "B" volts. However, the optimum operating conditions involve fairly low plate current (50 mils for two tubes), so that the plate dissipation is well within limits. The screen current in triode connection is only 2 to 2.5 mils, so that there is no danger of the screens overheating.

The tubes are operated about halfway between class A and class AB_1. The bias resistor for straight class A is 330 ohms, but the decrease in distortion is negligible.

The first stage is half of a 12AX7 high-mu twin triode, operating as a straight voltage amplifier with "contact potential" bias. Regular cathode-resistor bias, bypassed, was found to give hardly any improvement, and the feedback system is more stable with the simpler arrangement. This stage is direct-coupled to the other section of the 12AX7, operating as a split-load phase inverter.

The output transformer is a 20-watt universal replacement type as mentioned before, and is fully adequate for the power level developed by the 6AQ5's. If this amplifier were to be used with a large speaker system with extended low-frequency response, there might be some reason for employing a large high-fidelity type transformer, but for living-room use down to 60 or 70 cycles, such a transformer would be of no advantage at all.

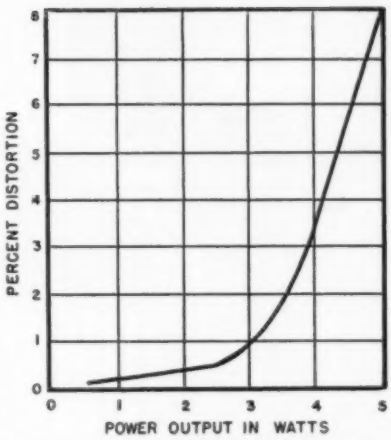


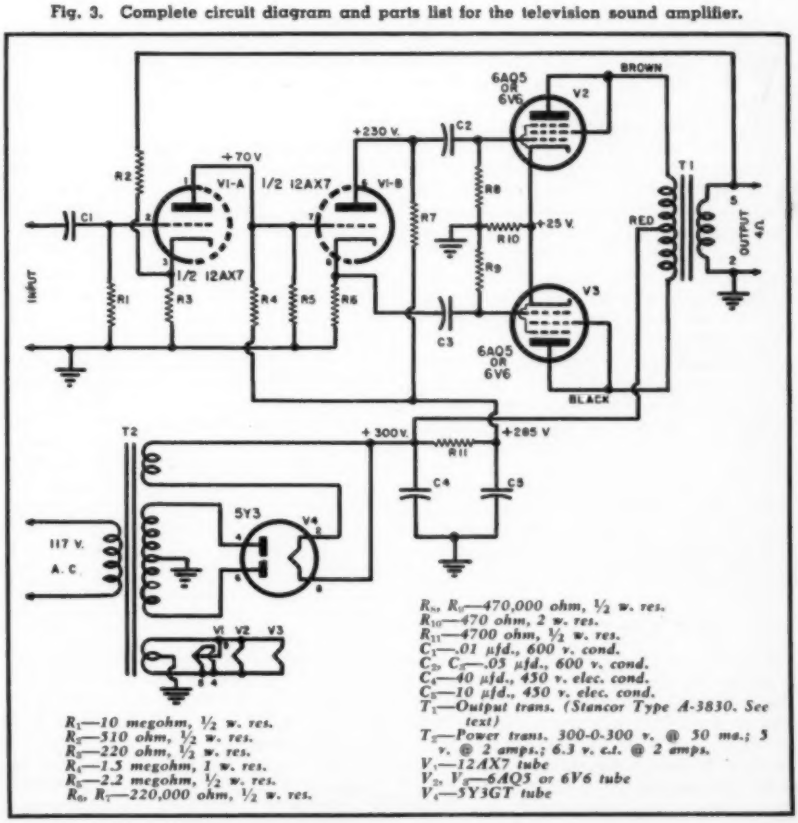
Fig. 2. Harmonic distortion vs. power output.

It is recommended that the transformer specified be used, because the negative feedback is taken from the voice coil winding, and the circuit was designed for stable feedback under all conditions with that particular unit, connected exactly as shown. The connections indicated are correct for any 3.2 to 4 ohm speaker. For an 8 or 15-ohm voice coil, connect to terminals 1 and 5 and ground terminal 1. The impedance match is not critical with triodes.

If a substitution of transformers is made, it is advisable to explore the range from 20 cycles to at least 100 kc.

(*Continued on page* 151)

Fig. 3. Complete circuit diagram and parts list for the television sound amplifier.



R_1—10 megohm, ½ w. res.
R_2—510 ohm, ½ w. res.
R_3—220 ohm, ½ w. res.
R_4—1.5 megohm, 1 w. res.
R_5—2.2 megohm, ½ w. res.
R_6, R_7—220,000 ohm, ½ w. res.
R_8, R_9—470,000 ohm, ½ w. res.
R_{10}—470 ohm, 2 w. res.
R_{11}—4700 ohm, ½ w. res.
C_1—.01 μfd., 600 v. cond.
C_2, C_3—.05 μfd., 600 v. cond.
C_4—40 μfd., 450 v. elec. cond.
C_5—10 μfd., 450 v. elec. cond.
T_1—Output trans. (Stancor Type A-3830. See text)
T_2—Power trans. 300-0-300 v. @ 50 ma.; 5 v. @ 2 amps.; 6.3 v. c.t. @ 2 amps.
V_1—12AX7 tube
V_2, V_3—6AQ5 or 6V6 tube
V_4—5Y3GT tube

Emergency TEST INSTRUMENT

By
FRED A. ORTH

Top and under chassis views of the versatile home-built test unit.

A handy unit for the busy service shop where an instrument breakdown can mean a financial loss.

WHEN a test instrument "conks out" the service technician is often placed in an unenviable position, especially when he is expected to keep the sets rolling out of his shop.

When such a unit must be returned to the factory for repairs or there is a delay in getting some replacement part, this can often represent a real dollar-and-cents loss to the technician. Having faced just such a problem, the author designed and built "Old Faithful"—a seven-section test instrument to be described in this article.

It should be emphasized that this unit is not a substitute for standard, commercially-built instruments but is merely a standby to be used in conjunction with the technician's remaining test instruments.

Each of the seven sections comprising "Old Faithful" operates independently. This feature increases the flexibility and serviceability of the instrument, a point most technicians will appreciate.

Section One

The first section of the instrument provides a circuit for measuring the leakage of electrolytic condensers at the working voltage of the receiver and is used in conjunction with a d.c. ammeter. It also provides a blocking condenser circuit for tracing audio signals with phones. In addition it may be used as a substitute 5 inch PM speaker for connection to a receiver's output transformer secondary. For details on the proper procedure for using the instrument in these applications see Table 1.

When measuring electrolytic leakage current it might be well to remember that for condensers of 300 volts or higher the permissible leakage is .5 ma. per μfd.; for 100 to 275 volts the allowable leakage is .2 ma. per μfd.; and for under 100 volts the limit is .1 ma. per μfd. These leakages are maximums and in some circuits these figures will have to be lowered.

To protect the milliammeter against damage because of a shorted condenser one of the following precautions should be taken. (1) Observing polarity, test the electrolytic condenser with an ohmmeter before conducting the leakage test. (2) In case the ohmmeter is the instrument which is out of commission, use the electrolytic quality test as outlined in Section Two. (3) When conducting the leakage test start with the highest meter range and turn the receiver on. Watch the meter and if the current builds up to where the pointer starts reaching for the highest reading on the dial, turn the receiver off promptly as the condenser is shorted and hence defective. If the condenser is not shorted, the meter may be set to a lower range and a reading taken. *Caution.* High voltage is present during the test and all of the customary precautions which apply in the presence of high voltages should be taken. When the test has been completed disconnect the negative terminal of the milliammeter first.

Section Two

Section Two of the instrument is an r.f.-i.f. signal tracer, an audio signal tracer, provides means for making a high resistance continuity test, serves as a tester for pilot lamps, and serves as a quality checker for electrolytic condensers.

A second audio signal tracer is provided in this section in anticipation of the prior application of the substitute speaker in Section One, in which case the audio signal tracer in Section One would not be available for audio signal tracing.

Since only 4½ volts are used to store the charge in the condenser for the electrolytic quality test, the test is only recommended for condensers of 150 volts and higher.

Section Three

This section provides resistor substitution facilities by means of nine 1-watt resistors which range in size from 47 ohms to 100 megohms. The section also provides eight substitute condensers, all of which except the lowest capacitance unit are paper, from .00025 μfd. to 1 μfd., 600 v. Low resistance visual continuity checks can be made by means of a 3.8 v., No. 13 lamp mounted in the center of the panel. This facility is especially convenient when testing for shorts in variable condensers or for testing continuity and shorts in tubes or other low re-

sistance circuits. If this test indicates an open in a resistance circuit, the suspected part should be discarded only if the open is confirmed by the high resistance continuity test described in Section Two.

Section Four

This section permits the capacity measurement of paper or mica condensers from .001 μfd. to 1 μfd. when used in conjunction with an a.c. voltmeter. Note that resistances R_{12} and R_{13} in the circuit diagram are based on the use of the a.c. voltmeter section of a *Simpson* Model 260 v-o-m. If other a.c. voltmeters are used with this instrument, the value of resistors R_{12} and R_{13} will obviously have to be computed.

When using the *Simpson* Model 260 with the instrument's .001-.01 μfd. setting (S_6 in the *a* position) the following voltage readings on the 10 volt a.c. scale will indicate the capacities specified: .6 volt = .001 μfd.; 1.1 volts = .002 μfd.; 1.5 volts = .003 μfd.; 1.9 volts = .004 μfd.; 2.5 volts = .005 μfd.; 3 volts = .006 μfd.; 3.6 volts = .007 μfd.; 4 volts = .008 μfd.; 4.4 volts = .009 μfd.; and 4.8 volts = .01 μfd. These values are lettered on the face of the instrument panel, directly beneath Section Four.

With the .01 -.1 μfd. setting (S_6 in the *b* position), meter readings on the 10 volt a.c. scale conform to the capacity of the condenser in that if the reading on the v-o-m meter scale is 2 volts the capacity of the unknown condenser is .02 μfd. Similarly with the .1-1 μfd. setting (S_6 in the *c* position) if this reading on the 10 volt a.c. scale is 8 volts the capacity of the condenser is .8 μfd.

When starting the test, set the a.c. voltmeter selector switch to a range in excess of line voltage so that if the condenser is shorted the meter will read the line voltage and no damage to the meter will result. If the condenser is shorted, the test voltage should be removed immediately since resistors R_{12} and R_{13} will not withstand full line voltage for any length of time.

Sections Five and Six

Each of these sections provides both a filter section hum check and electrolytic condenser substitution facilities with each section operating independently of the other. Section Five provides condenser substitutes of 4, 8, 12, 16, 20, and 40 μfd. while Section Six provides substitutes of 8, 12, 16, 20, 40, and 100 μfd. capacity. All of the condensers are rated at 450 volts except the 100 μfd. unit which is rated at 25 v.

Section Seven

This section provides a high frequency buzzer signal generator that generates signals ranging from 0 to over 100 mc. This signal may be injected in any stage of the receiver from the antenna to the speaker.

Additional Notes

Should your voltmeter be the instrument out of commission, voltages in a receiver may be tested for "presence" by means of a neon lamp which responds to voltages ranging from 90 to 550 either a.c. or d.c.

This emergency test instrument is housed in a metal cabinet measuring 8 x 10 x 4¾ inches. The chassis was chosen to fit the cabinet easily. Bakelite jacks provide insulation from the metal panel.

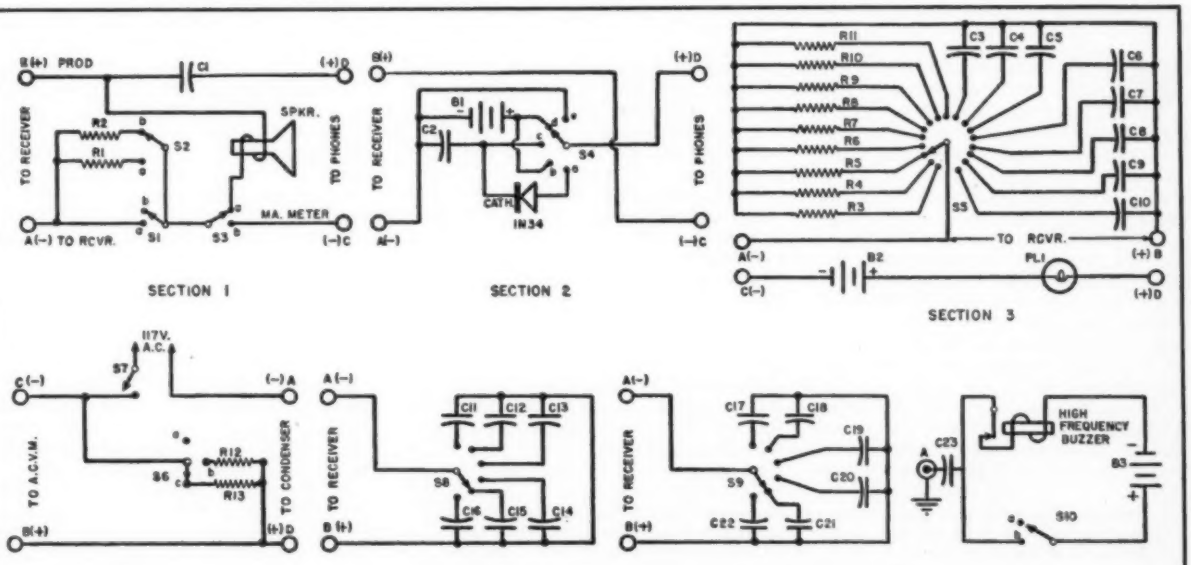
The paper condensers in Section Three are connected with one lead soldered to the switch in order to keep the leads as short as possible. Four of the six electrolytic condensers in each of Sections Five and Six are mounted under the chassis with the remaining two on top of the chassis. The resistors go under the chassis. The speaker is mounted on the inside back of the cabinet which is louvered.

The buzzer is mounted on top of the chassis as is the 3 volt battery. The battery is held in place by terminal strips on each side and by the lower speaker bolts which rest on top of the battery when the chassis is placed in the cabinet. The panel is soldered to the chassis and is finished in black.

In constructing this particular in-

(*Continued on page 90*)

Complete circuit diagram and parts list covering the seven-sections of the "emergency" test instrument.



SECTION 4

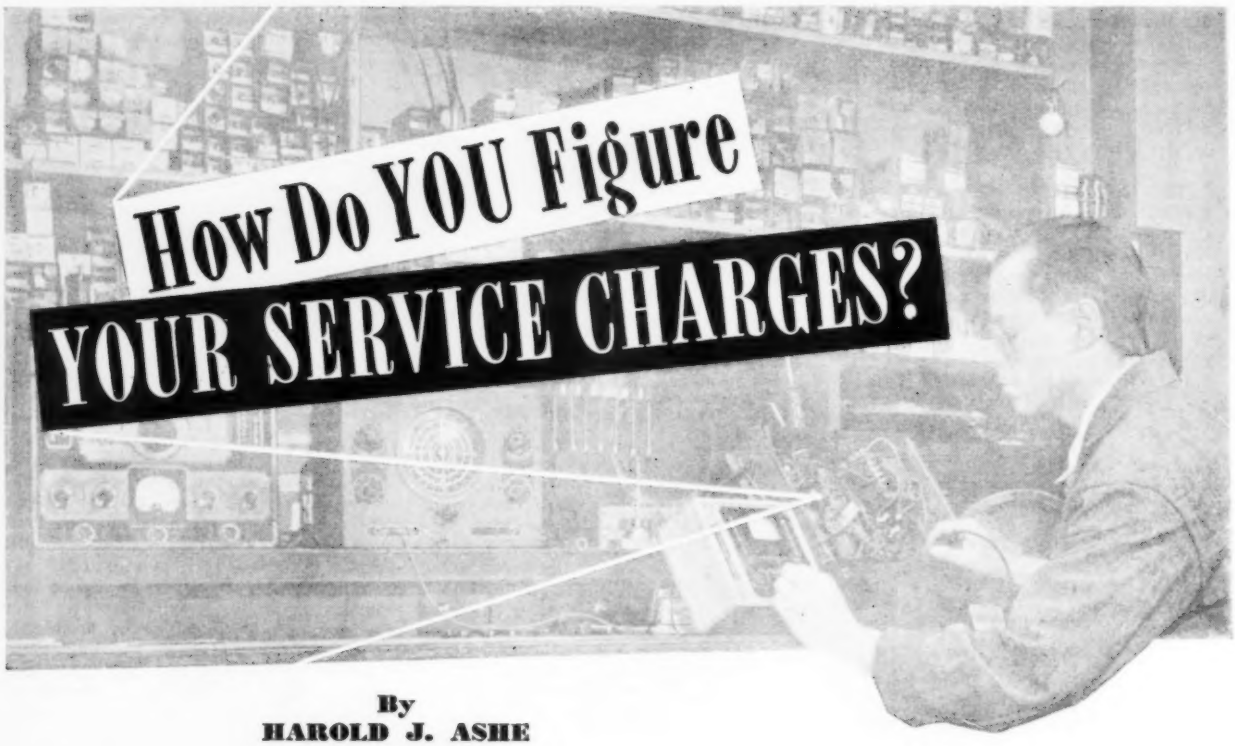
R_1—900 ohm, 1 w. res.
R_2—4000 ohm, 1 w. res.
R_3—47 ohm, 1 w. res.
R_4—270 ohm, 1 w. res.
R_5—400 ohm, 1 w. res.
R_6—1000 ohm, 1 w. res.
R_7—47,000 ohm, 1 w. res.
R_8—470,000 ohm, 1 w. res.
R_9—1 megohm, 1 w. res.
R_{10}—4.7 megohm, 1 w. res.
R_{11}—10 megohm, 1 w. res.
R_{12}—2960 ohm, 1 w. res.
R_{13}—231 ohm, 1 w. res.
C_1, C_6, C_{22}—.05 μfd., 600 v. cond.
C_2, C_7—.1 μfd., 600 v. cond.

SECTION 5

C_3—250 μμfd., 600 v. mica cond.
C_4—.005 μfd., 600 v. cond.
C_5—.02 μfd., 600 v. cond.
C_8—.25 μfd., 600 v. cond.
C_9—.5 μfd., 600 v. cond.
C_{10}—1 μfd., 600 v. cond.
C_{11}—4 μfd., 450 v. elec. cond.
C_{12}, C_{17}—8 μfd., 450 v. elec. cond.
C_{13}, C_{18}—12 μfd., 450 v. elec. cond.
C_{14}, C_{19}—16 μfd., 450 v. elec. cond.
C_{15}, C_{20}—20 μfd., 450 v. elec. cond.
C_{16}, C_{21}—40 μfd., 450 v. elec. cond.
C_{23}—100 μfd., 25 v. elec. cond.
S_1, S_5—S.p.d.t. toggle sw.
S_2—S.p.2-pos. sw.

SECTION 6

S_3—S.p.3-pos. sw.
S_4—S.p.17-pos. sw.
S_6—S.p.3-pos. sw.
S_7—S.p.d.t., center-off spring-return toggle sw.
S_8, S_9—S.p.6-pos. sw.
S_{10}—S.p.s.t. toggle sw.
Spkr.—5"; 3.2 ohm PM speaker
B_1, B_2—4½ volt "C" battery
B_3—3 volt "C" battery
PL_1—3.8 volt, No. 13 pilot lamp (Mazda)
Crystal—1N34 crystal
Buzzer—High frequency buzzer (E.F. Johnson "Speedx" No. 114-400)
All jacks to be bakelite units except the jack used in Section Seven which should be a coaxial jack.



How Do YOU Figure YOUR SERVICE CHARGES?

By
HAROLD J. ASHE
Tax Consultant

Many individually owned and operated service shops underprice competition not because of lower overhead but because many operating expenses are overlooked. Here is a handy check list.

WITH an increasing number of radio and television technicians setting up shop for themselves, this is as good a time as any to discuss service charges, pricing formulas, and certain business conceptions held by all too many owners of small shops.

Many established service shop owners who have learned the hard way look askance at these newcomers in the trade. This is usually not so much because they resent competition, as such, but because all too often these one-man and small shops represent *unfair* competition.

Old hands in radio and television servicing have long since discovered that there is more, much more, to conducting a successful shop than having the technical know-how, important as that is. Many established service shop owners criticize their new competition because the latter have smaller overhead, and therefore can successfully scale down their charges.

We'll agree that a disturbing number of small shops do maintain price schedules that are lower than their larger competitors. We disagree, however, that this is because, generally, the one-man and small shops have a pricing advantage of smaller overhead.

The reason that small shops can and do under-price is because they *think* they have lower overhead. Percentagewise, the typical shop employing only one technician and with the owner also working with tools is likely to have as high an overhead in dollars-per-technician (including the owner) as does a shop having six or eight men on its payroll.

While these newcomers are making it rough for established service shops whose owners know their costs, they are traveling a rough road themselves, even though they may not immediately be aware of the chuckholes ahead of them.

What, in effect, many of these new shop owners are doing is selling their own skilled labor piecemeal and with the prospect that they will make even less than they'd earn working on salary for another shop.

Not infrequently their prices are determined by the lowest prices quoted by the cheapest shop in the community, rather than a price commensurate with the service performed. Instead of making a charge that will permit a profit they make a charge, determined by the lowest priced shop in town, scale it still lower, and then hope for a profit that never accrues to them.

Or, they may attempt to determine prices by an over-simplified formula in which straight labor time is figured, plus a moderate addition for overhead, and a modest amount for "profit". Usually, this so-called "profit" disappears through the year to satisfy hidden overhead that has not been anticipated. This is service pricing reduced to the ridiculous. It might be amusing except for the fact that thousands of one-man shops, unschooled in costing procedures, employ this pricing formula to their own financial detriment as well as to that of ethical competitors who are trying to maintain

(*Continued on page* 146)

Table 1. Check list of representative overhead expenses. While the listing is far from all-inclusive, there are few shops which do not spend varying sums for practically all of the items tabulated. Even where the shop owner works out of his own home, certain utility expenses, rent, etc. should be charged to shop overhead.

Rent, light, heat	Salaries of non-productive employees
Telephone	Technicians' wages
Postage	Public liability insurance
Technical books, trade magazines	Property damage
Ledgers, accounting forms	Truck depreciation
Letterheads, stationery supplies	Truck insurance, including liability
Equipment depreciation	Loss of tools, equipment
Advertising	Depreciation of tools, equipment
Fire, casualty insurance	Non-productive supervisory time
Taxes and licenses	Call-backs on complaints
Donations	Unworked time, holidays, etc.
Association dues	Waste and spoilage
Losses from bad accounts	Social security tax (on employees)
Transportation costs	Unemployment insurance tax
Unproductive time (making estimates, etc.)	Workmen's compensation insurance
Business entertainment (if any)	Miscellaneous

A Mobile LOW-POWER 10 METER RIG

Over-all view of transmitter. See schematic diagram for identification of parts.

By
HARDIN G. STRATMAN

A well-engineered transmitter with a range of 5 to 10 miles. A standard vibrator power supply is used.

USUALLY when a sudden disaster such as a fire, a flood, or a windstorm occurs, there rarely is a means of communication available to link the scene of action to the broadcasting station over which a reporter might tell an eager and curious listening audience exactly what is happening as it happens. This situation also arises when covering special events such as parades or ball games.

Engineers at the *Gates Radio Co.*, Quincy, Illinois, designed the compact and useful mobile transmitter about to be described for remote broadcast pickup between 26.11 to 26.47 megacycles, a frequency band which effectively eliminates all of the previously mentioned hampering conditions. Since the unit's useful frequency range extends from approximately 25 to 30 megacycles it is easily adaptable for use in the 10 meter amateur band without changing any components.

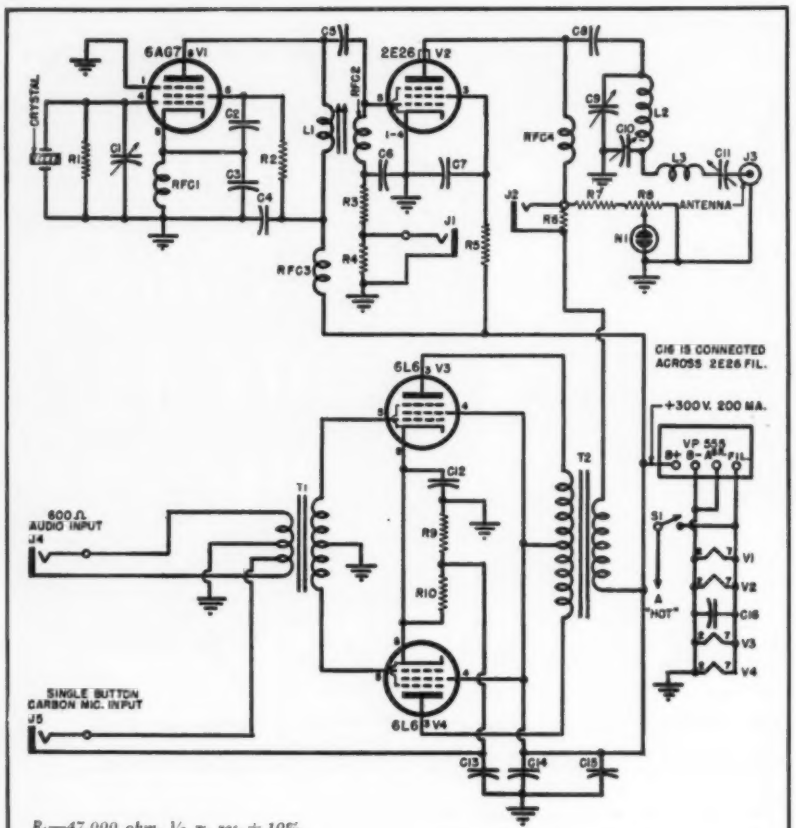
Circuit Description

The circuit arrangement of the transmitter is relatively simple. Using a crystal of from 8 to 10 megacycles, the oscillator stage triples in the plate circuit of a 6AG7 tube (V_1) and the resulting electrical energy is then injected into the grid circuit of a class C power amplifier stage utilizing a 2E26 beam power amplifier tube (V_2) which simplifies the tuning because it eliminates the necessity for neutralizing. The power amplifier stage is plate modulated by a pair of 6L6 tubes (V_3, V_4) working in the modulator stage. A pi-network is used in the antenna coupling circuit, a feature which might prove of especial interest to the reader. This pi-section matches the high impedance of the power amplifier tank circuit to the low impedance (approximately 20 to 60 ohms) of the antenna used while, at the same time, reducing harmonics. Although matching a high impedance to a low impedance reduces the voltage, the current is increased—a very desirable condition in a transmitting antenna. C_9 and C_{10} connected in series across L_2 form the plate resonant circuit which, of course, should always be tuned to the output frequency being used. The junction of C_{10} and L_2 is the matching point and since C_{10} is of greater capacity than C_9 its reactance will obviously be lower than that of C_9, a factor which will permit it to be tuned to match the characteristic low impedance of the quarter-wave antenna used. This circuit also reduces de-tuning of the power amplifier stage because of the variations in antenna characteristics which occur as the antenna sways or is approached by some object.

A very simple over-modulation circuit is provided in the transmitter. This consists of a quarter-watt neon bulb connected in series with a 250,000 ohm potentiometer (R_8) and a 270,000 ohm resistor (R_7) between the plate supply of the power amplifier and ground potential. By means of the variable potentiometer, the neon bulb can be made to flash with any value of modulation percentage.

The initial tune-up of the transmitter should be performed as follows: After first removing the plate cap from the 2E26 tube, turn the transmitter on and allow it to warm up. Then check the grid current of V_2 by means of a test meter through the grid current jack (J_3) provided on the front panel. Then adjust L_1 until 3.5 ma. is obtained on the test meter. Turn the transmitter off and replace the plate cap on the 2E26 tube. Insert a test meter of approximately 100 ma. in the plate current jack (J_2) and adjust C_9, C_{10}, and C_{11} for maximum capacity. Again turn the transmitter on and allow it to warm up. Then adjust C_9 (plate tuning) for minimum plate current (lowest dip on meter reading) and then decrease the capacity of C_{10} (output tank loading) approximately 1/16 turn. Re-adjust C_9 for the plate current dip and continue to decrease the capacity of C_{10} and re-adjust C_9 until the plate current is 50 ma. at the lowest point of the plate current dip reading. The adjusting of C_9 for a dip should always be the final adjustment in the tuning up procedure. The final setting of C_9 will normally be found to be about 1/3 to 1/2 meshed. C_{10} will be between 1/8 to 2/3 meshed and C_{11} will be fully meshed.

Excessive loading or antenna coupling is indicated by plate current in excess of 50 ma. If plate current at the dip is less than this, it indicates insufficient coupling or loading. To increase the loading, adjust the output tank coupling C_{10} by decreasing the capacity slightly. As a rule of thumb, it may be remembered that increasing the capacity of C_{10} (output tank coupling), decreases the loading. Conversely, decreasing the value of C_{10} increases the loading which, of course, always results in increased plate current. Any adjustment of C_{10} (output tank coupling) always requires a re-



R_1—47,000 ohm, ½ w. res. ± 10%
R_2—10,000 ohm, 1 w. res. ± 5%
R_3—10,000 ohm, ½ w. res. ± 10%
R_4—100 ohm, ½ w. res. ± 10%
R_5—10,000 ohm, 10 w. wirewound res.
R_6—100 ohm, 1 w. res. ± 5%
R_7—270,000 ohm, 1 w. res. ± 10%
R_8—250,000 ohm pot.
R_9—47 ohm, 1 w. res. ± 10%
R_{10}—130 ohm, 2 w. res. ± 5%
C_1—5-20 μμfd. var. ceramic trimmer
C_2—.1 μfd., 400 v. cond.
C_3, C_7—150 μμfd. ceramic cond.
C_4, C_6, C_7, C_8—500 μμfd. ceramic cond.
C_9—30 μμfd. var. cond. (APC type)
C_{10}—140 μμfd. var. cond. (APC type)
C_{11}—100 μμfd. var. cond. (APC type)
C_{12}, C_{14}, C_{15}—10/15/15 μfd., 25/450/450 v. elec. cond.
C_{13}—25 μfd., 25 v. elec. cond.
C_{16}—.1 μfd., 200 v. cond.
RFC_1—R.f. choke (Ohmite Z50)
RFC_2, RFC_3, RFC_4—R.f. choke (Ohmite Z28)
J_1, J_2, J_4, J_5—Open circuit phone jack
J_3—Coaxial cable socket
T_1—Single-button mike and line to p.p. grids trans.
T_2—5000 ohm p. to p. to 5000 ohm load trans.
S_1—S.p.s.t. toggle sw., heavy-duty type
N_1—NE51 neon bulb
Crystal—Fund. freq. ⅛ of output freq.
VP-553—Vibrator supply, 300 v. @ 200 ma., 6 v. d.c. input
L_1—12 t. #33 d.c.c. closewound on Millen #69041 iron slug form, ½" dia.
L_2—13½ t. #16 p.e. closewound, 9/16" i.d., self-supporting
L_3—16½ t. #16 p.e. closewound, 9/16" i.d., self-supporting
V_1—6AG7 tube
V_2—2E26 tube
V_3, V_4—6L6 tube

Diagram of mobile 10 meter transmitter. Any power supply delivering 300 volts at 200 milliamperes can be used. Transmitter delivers 10 watts amplitude modulated.

adjustment of C_8 (plate tuning) to bring the circuit back to resonance. Resonance is indicated by the plate current dip.

Touching a quarter-watt neon bulb to the top end of the whip antenna should produce a red glow in the bulb which indicates there is reasonable transfer of energy to the radiating system. But a neon bulb should never be relied upon as a tune-up indicator as this will result in excessive plate dissipation in the 2E26 tube, damaging it or greatly reducing its useful life. Excessive distortion may also result. A test meter should always be used to measure the plate current of the 2E26 tube when tuning the power amplifier circuit.

After the adjustment of antenna loading and plate tuning has been completed, it is advisable to recheck the grid current of the 2E26 tube. This may be accomplished by means of the test meter and the grid current jack provided on the front panel. Grid current should not exceed 4 ma. for maximum life of the tube but satisfactory operation will result for any value of grid current between 2.5 and 4 ma. L_1 may be adjusted for the correct current. A value of 3.5 ma. is to be preferred.

The variable condenser (C_1) connected across the crystal requires just an initial adjustment in conjunction with a reliable frequency standard as it is a vernier control upon the frequency and once set should not require further adjustment due to normal vibration or other effects. Once set, the oscillator plate tank circuit should require no additional tuning for any particular frequency and, in the power amplifier circuit, only the plate and antenna loading adjustments require an occasional retuning. R_8 is a variable control which determines at what percentage of modulation the neon bulb will flash. This control should be adjusted so that the neon bulb flashes when modulation peaks of 100% are exceeded. An oscilloscope and a sine wave audio generator are required for this operation.

Dummy Antenna

As is the case with most transmitters, attempting to tune or operate the transmitter in an unloaded condition will result in damage to the components of the output network. To eliminate the necessity of tuning the transmitter with the antenna connected, an effective dummy antenna at this frequency can be easily constructed from a 25 watt, 32 volt light bulb. To do so, remove the base from the light bulb, being careful to preserve the leads. Then insert one of the protruding leads into the output receptacle (J_3) of the transmitter and secure the other lead to the chassis near the receptacle and proceed with the tune-up.

Modulation

Modulation of the transmitter is accomplished by means of jacks provided on the front panel. 100% modulation can be obtained by applying a level of approximately 0 db. through J_4 by the use of an audio signal generator or a remote amplifier. By using a single button carbon microphone plugged into J_5, 100% modulation can also be obtained without the use of any other amplifier. Excitation voltage of approximately 5.5 volts for the microphone is obtained from a tap on the cathode bias resistor of the 6L6 modulator tubes.

Reception

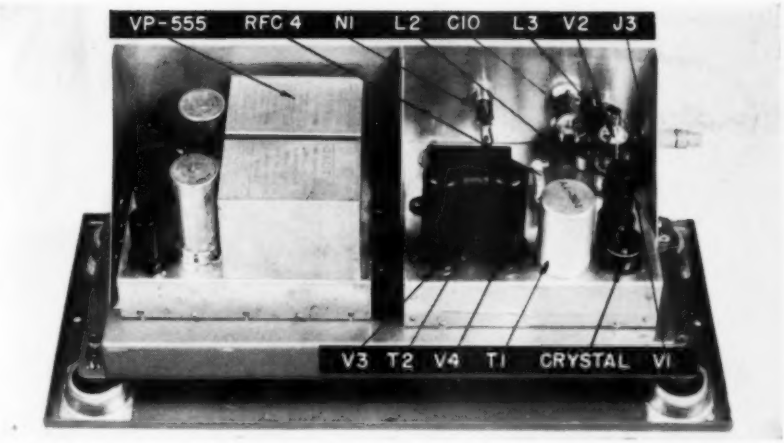
The power output of the transmitter is 10 watts amplitude modulated and it can be received over a distance of from five to ten miles with an ordinary communications receiver, depending on the intervening terrain and the car's position with respect to the receiving antenna. When the transmitting whip antenna is mounted on the rear bumper, field experience has shown that often a 2 to 6 db. signal strength gain may result when the front of the automobile is pointed towards the receiving antenna. Apparently the body tends to act as some sort of directive factor, increasing the frontal radiation somewhat. For best results, the receiving antenna should be as high as possible and cut to resonance at the operating frequency. Where feasible, a vertically polarized beam antenna at the receiving end will further extend the maximum usable range. Line of sight between the receiving and transmitting antenna is highly advantageous. Hills between the two antennas should be avoided if possible. Buildings and trees are highly absorptive at these frequencies and will cause some loss of

signal strength if they come between the receiving and transmitting antennas. Receiving locations having low electrical noise levels and freedom from automobile ignition interference will extend the usable coverage distance considerably.

Installation and Operation

The complete transmitter, consisting of two basic units—the transmitter proper and a standard vibrator type power supply, is only 18⅝" long, 8" wide, and 11" tall including shock mounts. Thus it lends itself especially well to mounting in the trunk of an automobile and the 6 volt battery is reasonably accessible merely by running two leads from the transmitter to the battery. If the antenna is mounted on the rear bumper, only a short length of coaxial cable is required to connect the antenna to the transmitter. The power supply will not be discussed here as any power supply that provides 6.3 volts for the filament and 300 volts d.c. at 200 ma. for the rest of the transmitter will suffice. Information on building such a supply can be obtained elsewhere. Incidentally, the transmitter should not be operated on a battery where the voltage measured at the transmitter input terminals is less than 5.8 volts as power output decreases rapidly and distortion increases excessively. Where the battery is known to be fully charged and low voltage is experienced at the transmitter input terminals, a voltage drop across the resistance of the connecting leads should be suspected or the possibly corroded connection investigated. This voltage drop can be eliminated by using two #8 wires (or larger) rather than depending on the car body to form one of the connecting leads. When corrosion of the body takes place an appreciable voltage drop may be experienced.

A length of RG-8U coaxial cable should be used to connect the transmitter output to the base of the 8 foot whip antenna. The impedance of this coaxial cable is 52 ohms which comes fairly close to matching the impedance of the antenna.



Rear view of completed unit showing location of various components. Refer to schematic diagram for parts identification. A vibrator-type power supply was used to furnish "B" voltage while the filament voltage was obtained from car battery.

A rig of this type makes an ideal portable or emergency standby. A power supply to operate off a.c. lines may be readily built of ordinary receiver replacement parts. Stock replacement transformers in this rating are generally available.

As the microphone current is supplied from the drop across the cathode resistor in the modulator tubes, no provision need be made for a separate source of d.c. for this purpose. Thus one of the design headaches of a dual purpose transmitter is eliminated.

Designed for those who must confine the bulk of their operating to mobile, this rig is also suitable for home operation since its low power should cause little TVI.

A multi-element beam antenna could be erected at the home station, giving the effect of considerably higher power.

A dynamotor or vibrator supply can be mounted in the car along with the whip antenna. Plug-in power cables will make the job of changeover a matter of a few minutes, and save the cost of an additional rig.

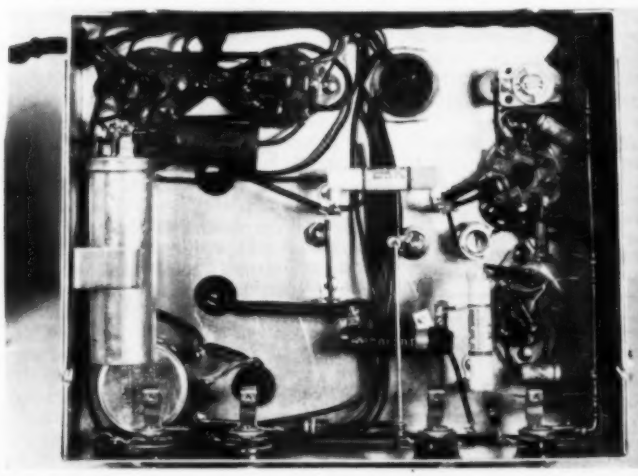
Parts Replacement

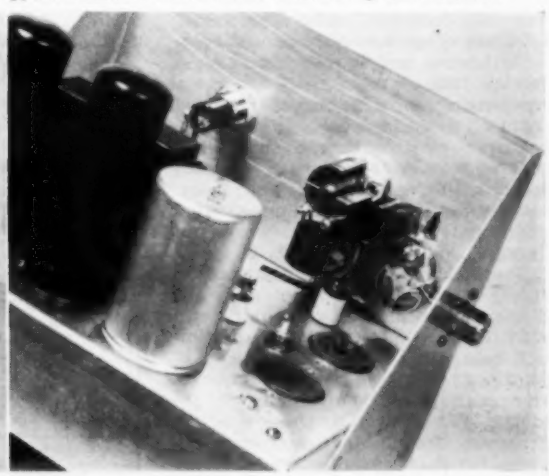
About the only parts that will need replacing will be the tubes. Weak 6L6 tubes will be evidenced by excessive distortion. A weak 6AG7 tube will probably refuse to oscillate or will not provide enough drive for the power amplifier stage. A weak 2E26 tube will cause reduced output and exhibit an inability to load up to 50 ma. plate current.

The noise, distortion, and frequency response of the transmitter exceeds class A network program lines and meets all requirements of the FCC pertaining to AM broadcasting stations. The frequency stability is plus or minus .005% and incidental frequency modulation is less than 100 cycles. Frequency response from 100 to 10,000 cycles is within 2 db. of being completely flat and the maximum distortion is 3½% between 100 to 7500 cycles at 85% modulation. Noise is better than 50 db. below 100% modulation.

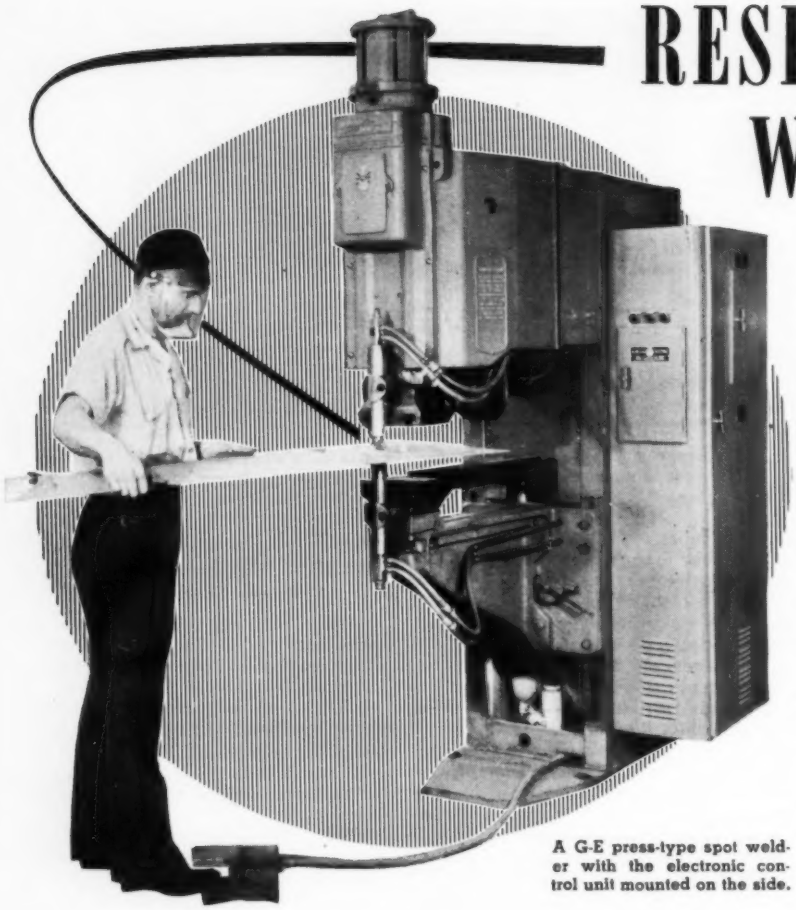
—30—

(Left) Bottom view of transmitter. (Right) Rear view of transmitter portion with tubes removed. Either APC type trimmer condensers can be used for C_{10} or C_{11}, as indicated in the parts list, or ceramic type condensers, shown in the author's rig, can be used.





RESISTANCE WELDING



A G-E press-type spot welder with the electronic control unit mounted on the side.

Resistance welding techniques provide a new tool for joining metals swiftly without using solders.

By
ED BUKSTEIN

NURTURED in the favorable climate of electronic control, resistance welding has become a rapid and efficient operation. As a result, production schedules and costs have been reduced, and welded assemblies are of uniformly high quality.

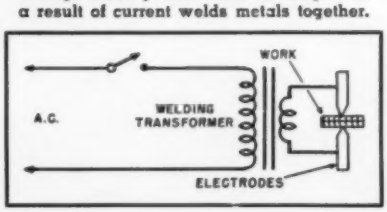
Resistance welding is a method of joining two or more pieces of metal by passing a high current through them. The heat developed as a consequence of this current melts the metals together, producing a strong joint. Unlike brazing and other methods, resistance welding adds no additional material to the work, and "lumpy" joints are avoided.

The welding current must be accurately controlled both in intensity and duration. Insufficient current or current for an insufficient length of time will result in poor fusion and a weak joint. At the other extreme, excessive current will burn holes in the metal. The answer to these exacting demands lies in the electronic circuits which accurately control both the duration and magnitude of the current.

The principle of resistance welding is illustrated in Fig. 1. The metal plates to be welded are held between two copper-alloy electrodes. Secondary current of the transformer, passing through the metal plates, produces the heat and the resulting weld. The welding transformer has a step-down ratio. Secondary voltage in the five to fifteen volt range is common in this application. This step-down of voltage is, of course, accompanied by a step-up of current.

Since rod-shaped electrodes are used, the weld is small and circular, corresponding to the end area of the electrodes. This is *spot* welding. The complete welding operation can be divided into three intervals of time. First, the metals must be brought into position and pressure applied to the electrodes. This interval is called the *squeeze time*. Secondly, power is applied and current passes through the metals. This is the *heat time*. Thirdly, the current is stopped but the metals remain in position under pressure of the electrodes. This is called the *hold time* and permits the weld to "set."

Fig. 1. The principle of resistance welding. When the switch is closed, the transformer secondary passes a high current through metal plates. Heat developed as a result of current welds metals together.



Hollow electrodes are sometimes used and water circulated through them to prevent overheating of the copper. Another cooling expedient is a system known as *pulsation welding*. Here, the heat time is broken down into a number of smaller intervals during which power is alternately applied and removed. The welding cycle under this arrangement would be as follows; squeeze time, heat time, cool time, heat time, cool time, heat time, hold time. During the cool time intervals, the heat is removed from the copper electrodes by the circulating water. The work, however, retains most of its heat during this period.

If the rod-shaped electrodes are replaced by a pair of rollers, and the work is passed between these rollers, a continuous *seam weld* will be produced. If pulsation welding is used in conjunction with these rollers, a series of uniformly spaced welds will be produced.

Use of the Ignitron

In the circuit of Fig. 1, the weld is produced by bringing the work into position and closing the switch for the required length of time. This arrangement is not satisfactory, however. In the first place, it is not possible to manually operate the switch at the high rate demanded by mass production techniques. Secondly, the duration and consequently the quality of each weld would be subject to errors of human judgment on the part of the operator. The duration of the weld is often only a few cycles of the line current, a requirement beyond the possibilities of both switch and operator.

The shortcomings outlined above can be resolved by replacing the switch with a tube. By the application of proper control voltage to its grid, the tube can be made conductive and nonconductive at the desired switching rate and for the optimum duration. The choice of tube for this application becomes mainly a question of current

(*Continued on page* 136)

Cabinets for High-Quality Direct Radiator Loudspeakers

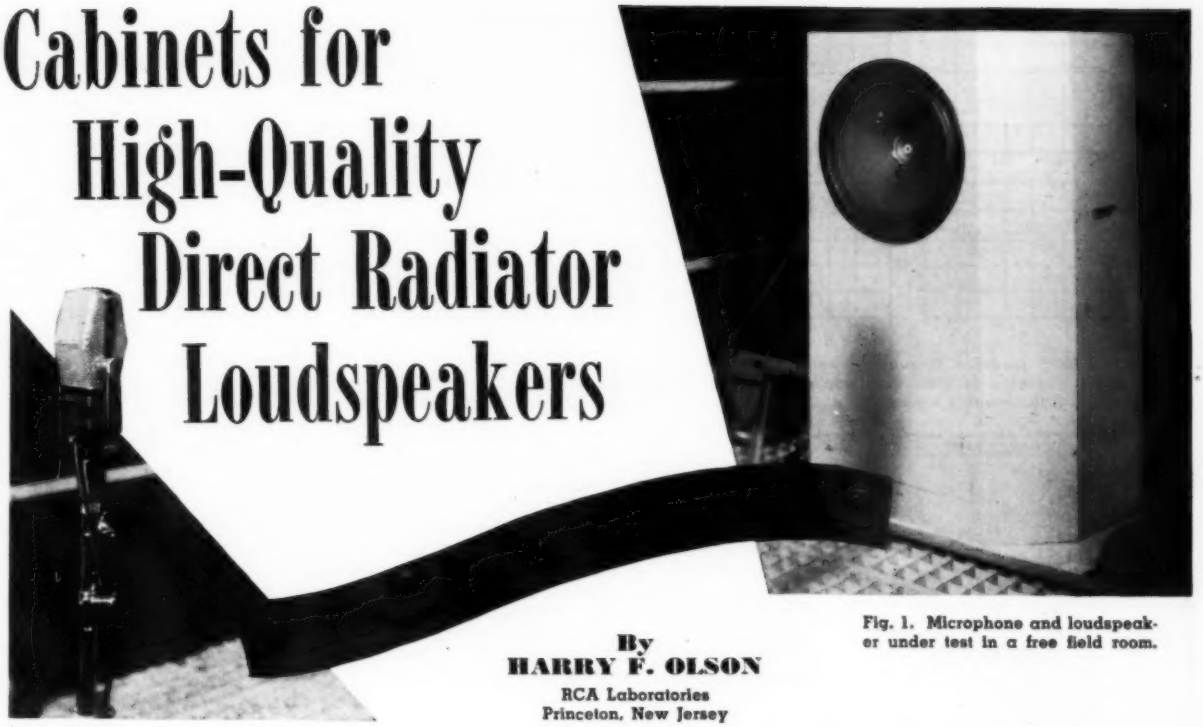


Fig. 1. Microphone and loudspeaker under test in a free field room.

By
HARRY F. OLSON
RCA Laboratories
Princeton, New Jersey

An analysis of the various factors involved in the design and construction of good speaker enclosures.

DIRECT radiator loudspeaker mechanisms for wide range sound reproduction are usually mounted in cabinets. In this system, there are four general parameters that influence the performance of the loudspeaker mechanism, namely, the internal acoustical impedance of the cabinet, the damping of the interior of the cabinet, the mounting of the loudspeaker mechanism, and the shape or the configuration of the outside of the cabinet. Since the effects of these parameters are independent of one another and occur in different portions of the frequency range, it is possible to analyze, measure, and segregate the different phenomena. For example, the size of the cabinet together with the loudspeaker mechanism characteristic determines the response in the low frequency range. The damping of the inside of the cabinet affects the response in the low and mid-frequency ranges. The mounting arrangement of the loudspeaker mechanism in the cabinet influences the response due to cavity resonance and diffraction in the high and mid-frequency ranges. The shape of the outside of the cabinet affects the response in the high and mid-frequency ranges due to diffraction. It is the purpose of this article to consider the above mentioned four different parameters that influence the performance of a direct radiator loudspeaker mechanism mounted in a completely enclosed cabinet.

Measurement Apparatus

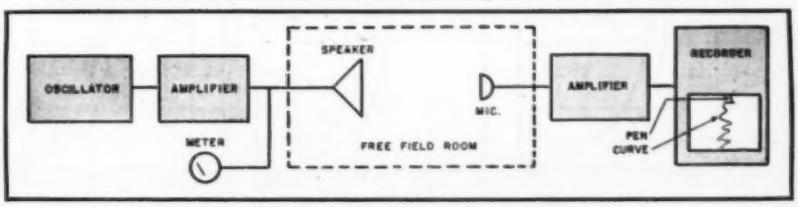
The loudspeaker response frequency characteristics depicted in this article were all taken in the free field sound room at the *RCA Laboratories* in Princeton, N. J. The response frequency characteristics were obtained by means of the automatic recording system shown schematically in Fig. 2. The output of an *RCA* Type 68B beat frequency oscillator is fed to an *RCA* Type BA-14A monitoring amplifier. The output of the monitoring amplifier is fed to the loudspeaker under test. The loudspeaker and microphone under test are located in the free field room[1,2] as shown in the photograph of Fig. 1. The sound output of the loudspeaker is picked up by means of an *RCA* Type 44BX velocity microphone. The microphone was calibrated by the reciprocity[3,4] method. The output of the microphone is fed to an *RCA* BA-11A preamplifier. This amplifier is compensated so that for constant sound pressure in free space the recorded output of the *Leeds and Northrup* "Speedomax" level recorder will be independent of the frequency.

Cabinet Volume

The considerations in this article will be confined to completely enclosed cabinets for the following reasons: Open back cabinets exhibit accentuated response in the region of cabinet resonance. It appears that it is difficult to control and subdue this resonance and thereby obtain a smooth response frequency characteristic. Therefore, open back cabinets have not been considered to be suitable for high quality wide range sound reproduction. The design of phase inverter or ported cabinets involves special tests and development work to obtain the optimum results. Unless this work is carried out with adequate test facilities, the performance will not be satisfactory. For example, equipment for

[1] Olson, H. F.; Journal Acoustic Society of America, Vol. 15, No. 2, 1943, page 96.
[2] Olson, H. F.; "Elements of Acoustical Engineering," D. Van Nostrand Co., New York, Second Edition, 1947, page 359.
[3] Olson, H. F.; RCA Review, Vol. 6, No. 1, 1941, page 36.
[4] Olson, H. F.; "Elements of Acoustical Engineering," D. Van Nostrand Co., New York, Second Edition, 1947, page 345.

Fig. 2. Apparatus used to obtain response frequency characteristic of loudspeakers.



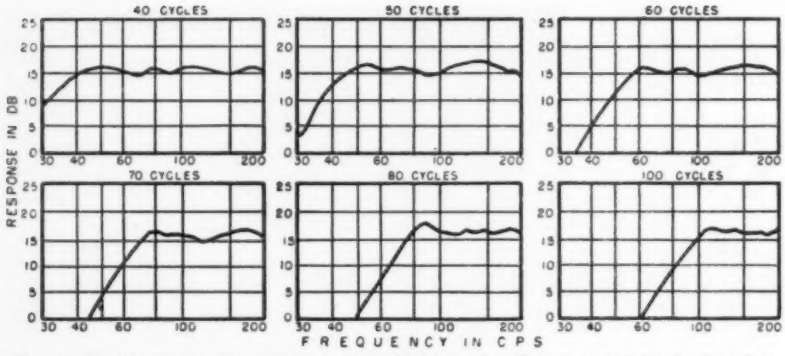


Fig. 3. Typical response frequency characteristics of 15" direct radiator loudspeaker mechanisms mounted in completely enclosed cabinets. The resonant frequency of the combination of the speaker mechanism and the cabinet is given above each of the graphs.

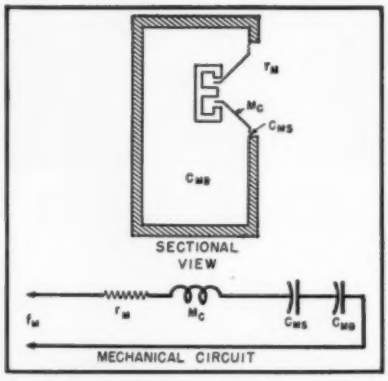


Fig. 4. Sectional view and mechanical circuit of a direct radiator loudspeaker mechanism mounted in a completely enclosed cabinet. In the mechanical circuit f_M = driving force, r_M = mechanical resistance of air load and suspension system, m_c = mass of the cone, voice coil, and air load, C_{MS} = compliance of the suspension system, and C_{MB} = compliance due to the cabinet volume.

obtaining the response frequency characteristics is almost mandatory. The only advantage of a phase inverter system is accentuated response in the low frequency region. This increased response is obtained at the expense of low frequency range. That is, the low frequency cut-off is lower in the completely enclosed cabinet than in the phase inverter or ported cabinet.

Since 15" loudspeaker mechanisms are almost universally used for wide range sound reproduction, the considerations in this article will be confined to this size mechanism. Typical response frequency characteristics for 15" loudspeakers for six different resonant frequencies are shown in Fig. 3. From these curves the builder can determine the characteristic he desires. As will be developed later the particular low frequency response may be tempered by the maximum volume of the cabinet which he is able to use. Since the characteristics of Fig. 3 are in terms of the resonant frequency of the loudspeaker mechanism and the cabinet volume, the next logical consideration is the determination of the resonant frequency of this combination.

The resonant frequency of a direct radiator loudspeaker mechanism located in a completely enclosed cabinet as shown in Fig. 4 is given by:

$$f_R = \frac{1}{2\pi}\sqrt{\frac{C_{MS}+C_{MB}}{m_c(C_{MB}C_{MS})}} \quad . \quad . \quad (1)$$

where:

m_c = mass of the cone, coil, and air, in grams

C_{MS} = compliance of the suspension system, in centimeters per dyne

C_{MB} = compliance of the cabinet, in centimeters per dyne.

The compliance[5] of the cabinet, C_{MB}, in centimeters per dyne, is given by:

$$C_{MB} = \frac{V}{\rho c^2 S_c^2} \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

where:

V = volume of the cabinet, in cubic centimeters

ρ = density of air, in grams per cubic centimeter

c = velocity of sound, in centimeters per second

S_c = effective area of the cone, in square centimeters.

The effective diameter of the cone of a "15 inch" loudspeaker mechanism is about 13 inches.

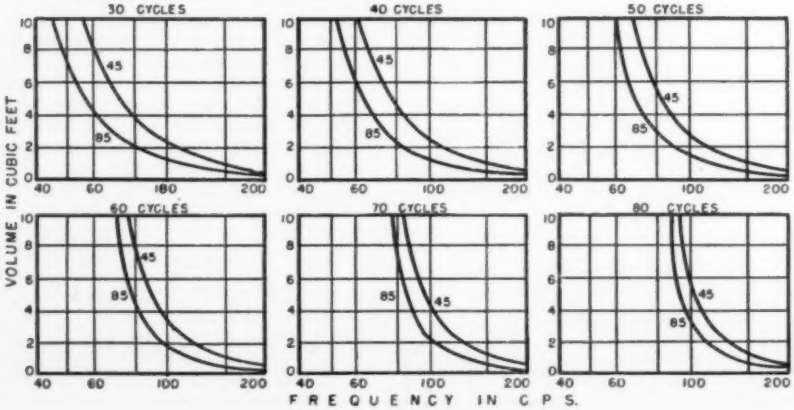
It should be mentioned in passing that Equation (2) assumes that the phase is the same for all elements of volume within the cabinet. If there is phase shift within the cabinet, there will be some deviation from the mechanical impedance obtained from distributed constant theory[6]. Actually, there is a phase shift within the cabinet for all frequencies. However, the phase shift decreases as the frequency decreases. Therefore, the discrepancy between the lumped and distributed constant theories will decrease as the frequency decreases. Equation (2) is used in this article to determine the resonant frequency of the combination of the loudspeaker mechanism and cabinet volume. At this frequency, the dimensions of any practical cabinet will be a small fraction of the wavelength. Under these conditions, the phase difference between the elements of volume within the cabinet will be small. Therefore, the discrepancy between the lumped constant value of Equation (2) and the distributed constant value is negligible.

The effective mass of the combination of the cone, voice coil, and the air load of the loudspeaker can be determined as follows: The loudspeaker should be placed in a flat baffle having dimensions of at least three feet by three feet. The resonant frequency, f_R, of the loudspeaker is determined by driving it from an oscillator and noting the frequency at which the maximum amplitude is obtained. Now a known mass, m_w, is glued to the cone of approximately the same mass as the cone. The resonant frequency, f_{RW}, of this combination is determined by noting the frequency of maximum amplitude. From these constants the effective mass, m_c, in grams, of the cone, voice coil, and air load can be obtained from the expression:

$$m_c = \frac{f_{RW}^2}{f_R^2 - f_{RW}^2}\, m_w \quad . \quad . \quad . \quad . \quad (3)$$

where:

Fig. 5. The fundamental resonant frequency of the combination of a direct radiator loudspeaker mechanism mounted in a cabinet as a function of the cabinet volume. Numbers above graphs refer to resonant frequency of mechanism. The numbers on the curves give the mass of the cone, voice coil, and the air load.



[5] Olson, H. F.: "Elements of Acoustical Engineering," D. Van Nostrand Co., New York, Second Edition, 1947, page 152.

[6] Meeker, Slaymaker & Merrill: Journal Acoustical Society of America, Vol. 22, 1950, page 206.

m_c = effective mass of the cone, in grams
m_w = mass of the added weight, in grams
f_R = resonant frequency of the loudspeaker, in cycles per second
f_{RW} = the resonant frequency of the loudspeaker with the mass m_w added, in cycles per second.

The compliance of the suspension system, C_{MS}, in centimeters per dyne is given by:

$$C_{MS} = \frac{1}{(2\pi f_R)^2 m_c} \quad . \quad . \quad . \quad . \quad (4)$$

where:
C_{MS} = compliance of the suspension system, in centimeters per dyne
f_R = resonant frequency of the loudspeaker in cycles per second
m_c = mass of the cone, voice coil and air load, in grams, and as determined from Equation (3).

Now all the constants of the system are known. The cabinet volume required to obtain a particular resonant frequency of the combination of the loudspeaker mechanism and cabinet can be determined from Equations (1), (2), (3) and (4). If the builder does not want to carry out the computations, he can obtain a reasonably accurate value of this resonant frequency from the procedure which will be explained in the next paragraph.

The resonant frequencies of the combination of 15 inch direct radiator loudspeaker mechanisms and completely closed cabinets, as a function of the cabinet volume, are shown in Fig. 5. Graphs are given for six resonant frequencies, f_R, of the loudspeaker mechanism mounted in a large flat baffle. The resonant frequencies are 30, 40, 50, 60, 70, and 80 cycles. Graphs for heavy and light cones are given for each resonant frequency. These two weights represent the two extremes of combined cone, coil, and air load mass. It is possible to estimate whether the cone is heavy, light, or medium by inspection of different loudspeakers. The resonant frequency of the loudspeaker mechanism can be determined by the oscillator method as outlined before or from the manufacturer's data. From the graphs provided, it is possible to interpolate between cone weights and resonant frequency of the mechanism to obtain the required cabinet volume from the resonant frequency of the combination.

Preferred Cabinet

The cabinet shown in Fig. 6 has been found to be particularly suitable for 15 inch wide range loudspeaker mechanisms as, for example, the *RCA* Types LC1A, 515S1, and 515S2. The internal volume of the cabinet shown in Fig. 6 is 8 cubic feet. The cabinet can be scaled up or down in volume by appropriate changes in the dimensions. It will be seen that the cabinet is made of relatively heavy wood with suitable bracing for reducing the vibration of the large flat surfaces. It will be shown in a later section that

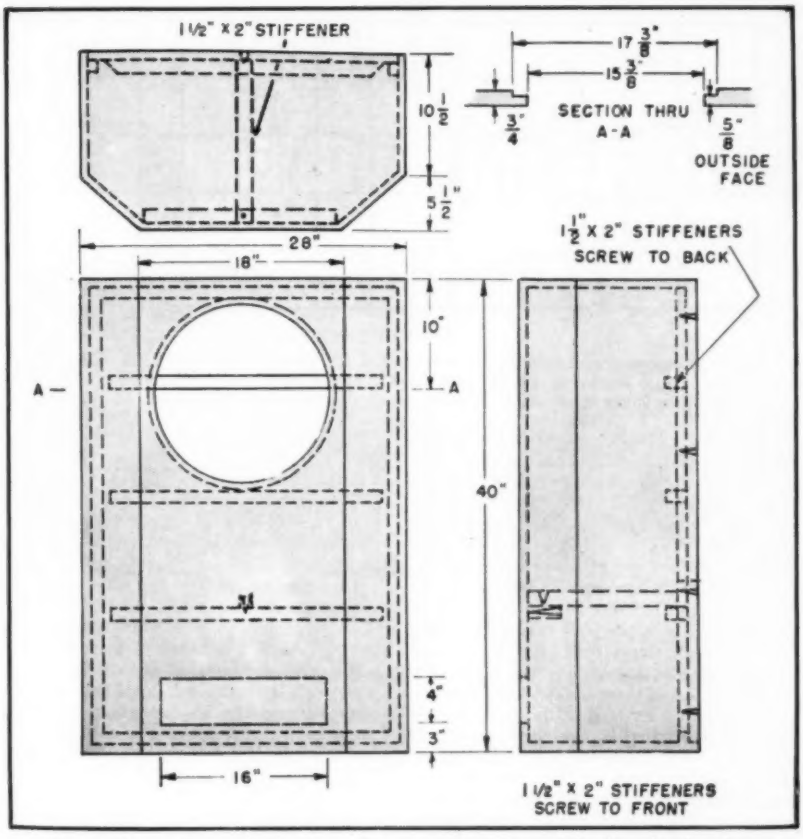
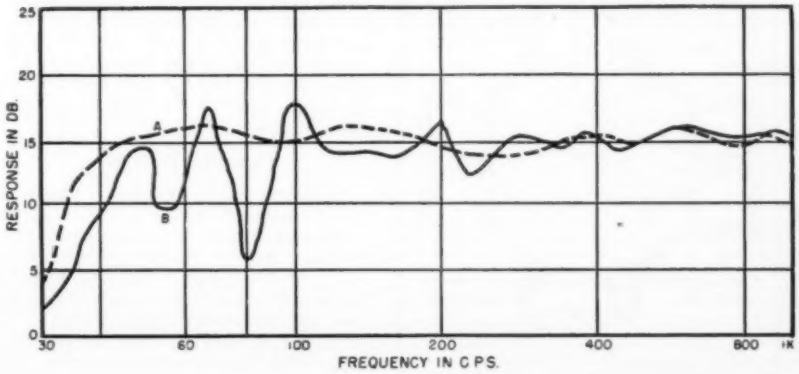


Fig. 6. Front, plan, and side views of a properly engineered loudspeaker housing.

the vibration of the walls of a cabinet introduces large variations in the response frequency characteristic. The inside surfaces of the cabinet are treated with absorbing material to reduce the standing sound wave system inside the cabinet. It will be shown in a later section that the standing sound waves in an undamped cabinet produce wide variations in the response frequency characteristic. The loudspeaker mechanism is mounted flush with the front surface of the cabinet. It will be shown in a later section that the resonance and diffraction effects produced by a cavity in front of the cone will introduce variations in the response frequency characteristic. The outside configuration of the cabinet introduces variations in the response frequency characteristic due to diffraction. It will be shown in a later section that the outside configuration of this cabinet reduces the deleterious effects of diffraction upon the response frequency characteristic.

A cabinet of the type shown in Fig. 6 will be used in the sections which follow to illustrate the effects of cabinet wall vibration, standing sound waves

Fig. 7. Response frequency characteristic of a 15" loudspeaker mechanism mounted in a cabinet of the type shown in Fig. 6. (A) Showing the elimination of deleterious effects due to the vibration of the cabinet by the use of heavy and well braced walls. (B) Response when deviations, i.e., walls made of thinner wood and the elimination of stiffeners, in the design of Fig. 6 were permitted.



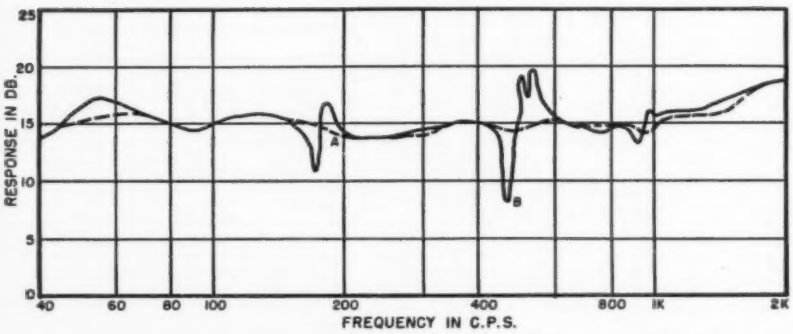


Fig. 8. Response frequency characteristic of a 15" loudspeaker mechanism mounted in the cabinet shown in Fig. 6. (A) Good response obtained by treating inside of cabinet with damping material. (B) Poor response when damping material was omitted.

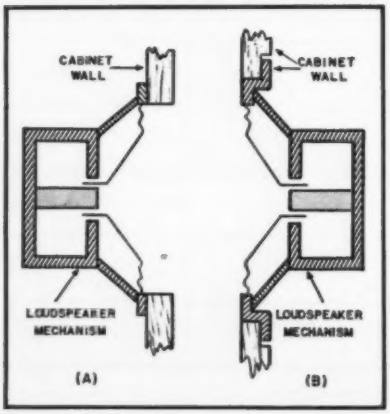
within the cabinet, loudspeaker mechanism mounting in the wall of the cabinet, and the exterior configuration of the cabinet upon the response frequency characteristic. The experiments to illustrate these effects were carried out so that the result and response frequency characteristic would depict the effect of one phenomenon at a time. This procedure will be evident in the text describing the tests and the results obtained.

The *RCA* Type LC1A loudspeaker mechanism was used in the tests which will be described in the sections which follow. The mass of the cone, voice coil, and air load of this loudspeaker mechanism is 85 grams. The measured resonant frequency of the mechanism used in these tests was 35 cycles. The resonant frequency of the combination of the loudspeaker mechanism and the preferred cabinet shown in Fig. 6 was 52 cycles.

Cabinet Wall Construction

In order to obtain smooth response in the low frequency region, it is necessary to use a well braced cabinet. If the walls of the cabinet are allowed to vibrate, peaks and dips will be introduced in the response, because the vibration of the different panels of the cabinet causes the radiation of sound from these panels which may be in- or out-of-phase with the sound radiated by the cone. Furthermore, the vibration of the heavy, high "Q" panels of the cabinet introduces poor transient response, because the build-up and decay periods of the excited panels are very long.

Fig. 9. Two different methods of mounting direct radiator loudspeaker mechanisms in wall of cabinet. (A) With mechanism mounted on back of cabinet wall. (B) Mechanism mounted flush with front surface of cabinet.



In order to confine the effects of the vibration of the walls of the cabinet without any other effects which mar the response, a cabinet of the configuration and dimensions shown in Fig. 6 was used with the inside of the cabinet damped and the loudspeaker mounted flush with the front of the cabinet. The walls were made of thinner wood than that shown in Fig. 6. In addition, all bracing strips were eliminated. A typical response frequency characteristic of a loudspeaker mechanism mounted in a cabinet with vibrating walls is shown in Fig. 7B. It will be seen that the vibrating panels introduce wide variations in the response frequency characteristic. In this experiment, it is difficult to isolate the effect of the vibrating panels completely because the damping material mitigates the vibrations of the panels to some extent. The response frequency characteristic of a loudspeaker mechanism in a cabinet of the same dimensions as Fig. 6, but with rigid and well braced walls, is shown in Fig. 7A. The characteristics of Figs. 7A and 7B show that it is very important that a solid, well braced cabinet be used to insure a smooth response frequency characteristic. The walls of the cabinet should be made of wood ¾ inch thick. Additional strips of 1½ inch by 2 inch hardwood should be glued or screwed to the inside of the panels having large flat areas as, for example, the back and the front of the cabinet. Additional bracing can be obtained by running a 1½ inch by 2 inch tie strip from the front to the back of the cabinet as shown in Fig. 6.

Cabinet Damping

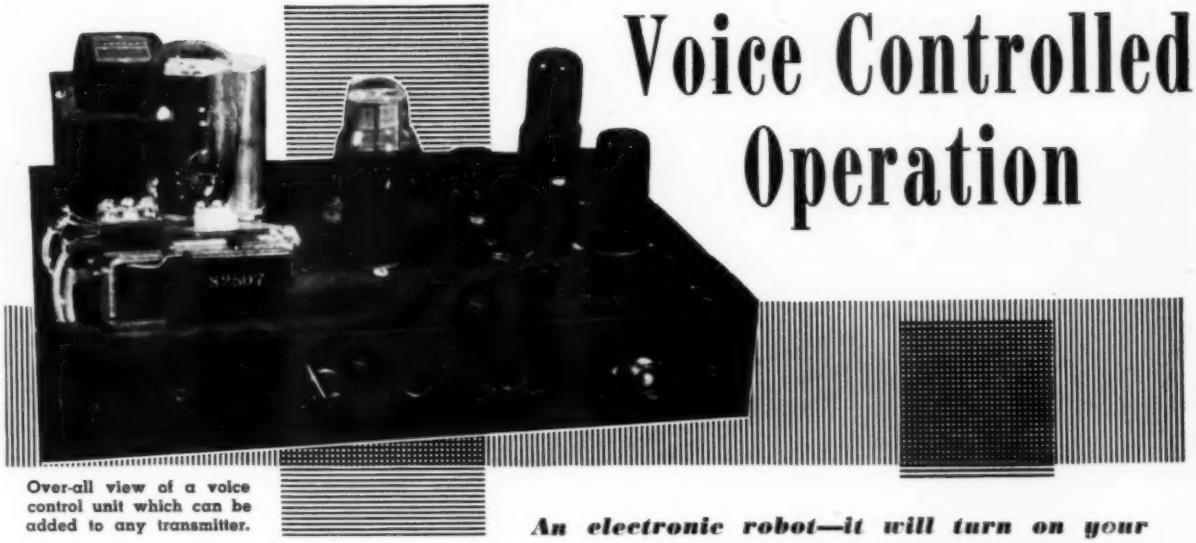
Standing wave systems on the inside of the cabinet will interact with the loudspeaker cone to produce variations in the response frequency characteristic. This is due to the variation in acoustical impedance presented to the cone by the complex sound wave pattern in the cabinet. For example, if there is a pressure loop at the loudspeaker cone, the acoustical impedance presented to the loudspeaker cone will be high and the motion of the cone will be retarded. If there is a particle velocity loop at the loudspeaker cone, the acoustical impedance presented to the cone will be small and the motion of the cone will be accentuated. The result will be corresponding dips and peaks in the response frequency characteristic. A typical response frequency characteristic of a loudspeaker mechanism mounted in the well braced cabinet of Fig. 6, but without damping material, is shown in Fig. 8B. In this case, the only deviation from the proposed cabinet of Fig. 6 is the absence of damping material. The ragged response in the region between 400 to 1000 cycles is due to standing waves within the cabinet. These standing wave patterns can be reduced, so that the effects upon the response frequency characteristic are negligible, by several different damping arrangements. One procedure is to line the front, back, and sides of the cabinet with 1 inch hair felt or the equivalent. The important thing is that the lining material should exhibit high absorption characteristics. Another procedure is to line the side walls and, in addition, hang a heavy blanket of hair felt across the full width of the cabinet half way between the front and the back. Still another method is to fill the entire volume with a fluffed out soft material such as kimpac. A typical response frequency characteristic, after the undamped cabinet has been treated with absorbing material, is shown in Fig. 8A. It will be seen that the variations in response exhibited by the undamped cabinet have been eliminated. Furthermore, the accentuated response at the resonant frequency has been reduced somewhat by the addition of the damping material.

Mounting Arrangement

The mounting arrangement of the loudspeaker mechanism in the front wall of the cabinet influences the response due to the resonances of the cavity in front of the mechanism. In addition, variations in the response are produced by reflection and diffraction from the circular boundary of this cavity. The standard mounting arrangement for loudspeaker mechanisms which has been used for years is shown in Fig. 9A. Referring to Fig. 9A, it will be seen that the cabinet wall forms a cavity in front of the loudspeaker. The resonances and antiresonances of this cavity, as well as reflections and diffractions of this wall edge, introduce variations in the response frequency characteristic as shown in Fig. 10A(a). These variations in response can be reduced by the improved loudspeaker mechanism mounting arrangement as shown in Fig. 9B. It will be seen that the cavity in front of the loudspeaker mechanism has been materially reduced. The reflecting edge of the cutout in the cabi-

(Continued on page 84)

A Novel Unit for Voice Controlled Operation



Over-all view of a voice control unit which can be added to any transmitter.

An electronic robot—it will turn on your transmitter automatically at your command.

By
E. A. ANDERSON,
VE6OD

THE unit to be described was built for use at VE6OD and since it has worked out rather well the author thought other hams might be interested in the details. After looking over several circuits we decided to design something that would meet the need but be just a bit different. Since we did not want to make any changes in the transmitter itself, a different type of circuit had to be evolved. Also since we wanted the minimum of delay in putting the transmitter on the air when the mike was being used it was evident that something a little more elaborate than usual would be required.

From the circuit diagram it is easy to see that the first two tubes are used in an ordinary preamp layout. From there on the signal is passed through an ordinary 3:1 audio transformer and then rectified by the 6H6 tube. The potentiometer R_7 and the condenser C_6 make up the time delay determining circuit. C_6 was made up of paralleled units in order to provide the odd value but a stock 4 μfd. unit could be used if desired. The arm of the potentiometer is connected through limiting resistor R_8 to the grid of the 2050 thyratron tube. This tube is designed to work from one side of the high voltage secondary of the power transformer and resistor R_{10} is a current limiting resistor. The value of R_{10} will depend on the transformer voltage.

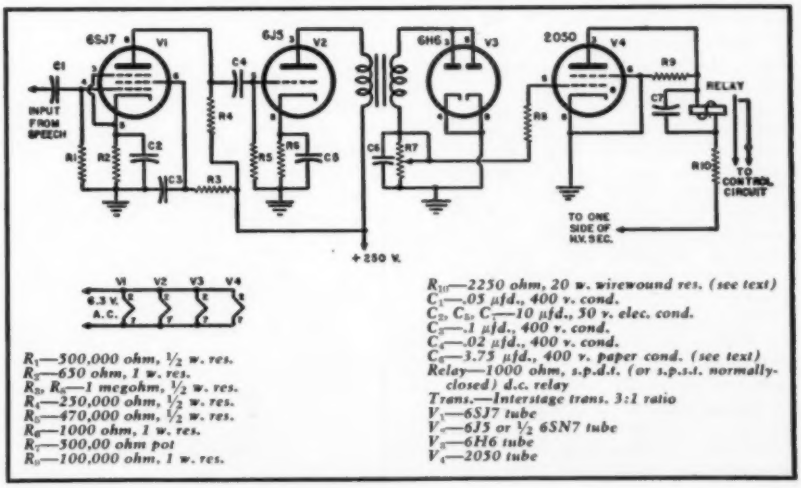
R_9 is connected to ground and is designed to permit a small amount of a.c. to flow through the relay winding to prevent permanent magnetization of the core. The relay used is a telephone type with normally-closed contacts and a coil resistance of 1000 ohms. Relays of greater sensitivity can be used if desired. Condenser C_7 is connected across the relay coil and serves to filter out the pulsating d.c. from the plate of the 2050 thyratron and keeps the relay from chattering.

We found by experimentation that the best results with this unit were obtained when four tubes were used. One tube could have been eliminated but since the object was to get the transmitter on the air quickly and without losing too much of the first syllable, the fourth tube has paid off. The resultant circuit is almost equivalent to a regular speech amplifier which gives a good healthy sock quickly. Maximum delay appears to be 5 or 6 seconds. The timing usually used when on the fone net is 1 to 2 seconds which gives fairly snappy operation. No trouble was experienced with volume from the loudspeaker kicking the transmitter on except in cases of high frequency heterodyne. Of course, headphones can be used to make sure that such a thing will not happen and have been used by the author in cases of high QRM.

A number of relays are used in the transmitter to control operation as well as in the antenna circuit for switching and in the receiver for muting. A 24 volt supply is used to operate these relays and connections are made from the two binding posts on the unit to this circuit. In this way

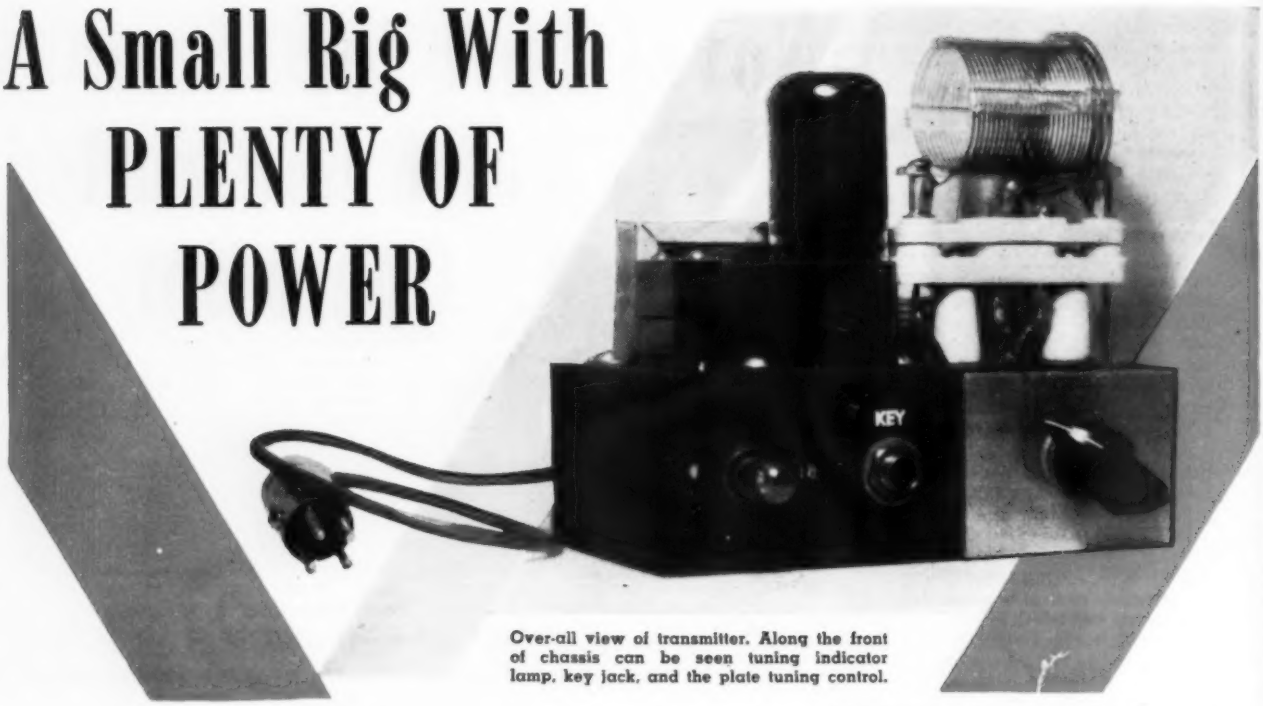
(*Continued on page* 98)

Complete schematic diagram of the four-tube, voice controlled robot unit.



R_1—500,000 ohm, ½ w. res.
R_2—630 ohm, 1 w. res.
R_3, R_6—1 megohm, ½ w. res.
R_4—250,000 ohm, ½ w. res.
R_5—470,000 ohm, ½ w. res.
R_8—1000 ohm, 1 w. res.
R_7—500,00 ohm pot
R_9—100,000 ohm, 1 w. res.
R_{10}—2250 ohm, 20 w. wirewound res. (see text)
C_1—.05 μfd., 400 v. cond.
C_2, C_5, C_7—10 μfd., 30 v. elec. cond.
C_3—.1 μfd., 400 v. cond.
C_4—.02 μfd., 400 v. cond.
C_6—3.75 μfd., 400 v. paper cond. (see text)
Relay—1000 ohm, s.p.d.t. (or s.p.s.t. normally-closed) d.c. relay
Trans.—Interstage trans. 3:1 ratio
V_1—6SJ7 tube
V_2—6J5 or ½ 6SN7 tube
V_3—6H6 tube
V_4—2050 tube

A Small Rig With PLENTY OF POWER



Over-all view of transmitter. Along the front of chassis can be seen tuning indicator lamp, key jack, and the plate tuning control.

By
LEON A. WORTMAN, W2LJU

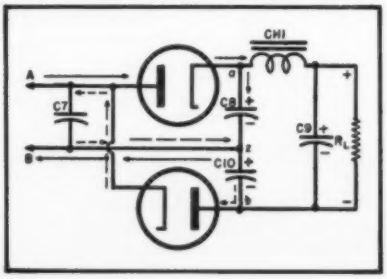
Designed especially for the ham living in crowded quarters, this compact unit is rated at 12 watts.

AT LEAST one ham I know has stayed off the air because of the apartment shortage. Whenever he expresses his frustrated desire to build a rig and pound brass, his wife draws herself up to her full 5 feet 2 inches and says, "What? In this two-by-four apartment you want to crowd the place with equipment when there isn't even enough room for me to hang my nylons!" That response has stopped the poor guy cold for the last three years. Each Saturday morning he can be seen with his nose pressed against the plate glass windows of the stores on radio row, a pathetic figure of a man. Out of sympathy for my friend and his fellow sufferers, I constructed a "small but powerful" rig, one that won't crowd the wife.

It's a 12-watt job, compact and efficient, easy to construct in an evening's time, ideal for the beginner, for the fellow who gets a kick out of compact equipment, and for the fellow who wants a standby installation. Any ham who has pounded brass will tell you that 12 watts of rig gets an operator plenty of DX and rag chews. The rig uses a 6V6GT tube as a crystal-controlled pentode oscillator and, except for the small power transformer, all components are mounted on a chassis that measures only 3"x5"x1¾". Contained on this chassis are the oscillator tube, crystal, tuning coil and condenser, the voltage doubler, and the power supply filter.

The only way to achieve this compact construction was to mount the power transformer as a separate unit. The elimination of rectifier tubes has been made possible by the availability of selenium rectifiers. These rectifiers are small, require no heater elements, are efficient and capable of withstanding high peak current surges without breakdown. The life expectancy of a selenium rectifier is quite long. They are available in a variety of ratings to meet all sorts of designs. For our purpose, the 75 milliampere unit is excellent with its 900 milliampere peak rating. Thus we have the power supply rectifiers. They can be installed without worrying about burnout. The power transformer is a *Merit* #P-3045, which has a half-wave 117 volt, 50 milliampere secondary, and a 6.3 volt, 1.5 ampere filament winding. The "high voltage" secondary is rated at a little under 6 watts but, because power is drawn intermittently (only when the key is down), it works quite nicely in this application without overheating We obtain a voltage that is much higher than 117 from the secondary by using a voltage doubler circuit.

Fig. 1. The basic voltage doubler circuit.



The voltage doubler is by no means a new or even recent invention. The idea has been used by many receiver manufacturers although I haven't seen many ham circuits making use of this technique. It's intriguing to think that one can take a voltage and, without the use of inductors or transformers, actually double it. And it really is quite simple. The basic circuit of a voltage doubler is shown in Fig. 1. The voltage doubler must operate from an alternating current power source. Because of the unidirectional characteristic of rectifiers, current flows through only one of the rectifiers for each half cycle of the line's alternating polarity. When the polarity at point *A* is positive with respect to point *B*, the current flow is as indicated by the solid arrow. This flow of current charges C_8 and point *a* is positive with respect to point *z*. During the half cycle which makes point *B* positive with respect to point *A*, current flows only in the direction indicated by the broken arrow. This flow of current makes point *z* positive with respect to point *b*, charging C_{10}. This leads to the conclusion that, since C_8 and C_{10} are in series from point *a* to point *b*, the voltage measured across *a* to *b* is the sum of the charges on the individual condensers. However, one condenser is discharging while the other is charging. The re-

sulting output voltage is, therefore, not actually twice the voltage of the supply line. A more correct name than "voltage doubler" is voltage adder; the voltage across C_9, at any given instant, being added to the voltage across C_{10}. The ripple frequency of this circuit is twice the line frequency. In this regard, the "symmetrical voltage doubler" is similar to the full-wave rectifier. If condensers C_9 and C_{10} are not approximately equal in value, the ripple voltage will contain a component of the line frequency. It is usually assumed that the two condensers of a voltage doubler circuit will be equal in value, and such is the case in the power supply of our little transmitter.

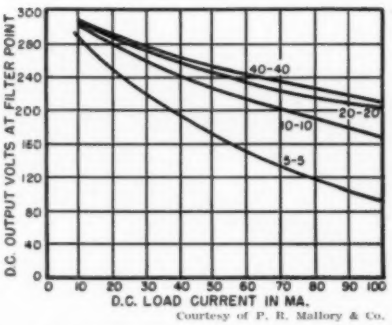
The capacitances of C_9 and C_{10} very definitely affect the output voltage of the power supply. Fig. 2 shows the relationship between the capacitances, load current of the oscillator tube, and the output voltage. It is then obvious why 20 μfd. has been selected as the value of both C_9 and C_{10}. With the values given in the transmitter schematic wiring diagram of Fig. 3, the voltage output of the power supply is about 250.

The chassis layout can be seen in the photographs of the completed unit. The power supply components, except for the small power transformer, are mounted across the back edge of the chassis top. The radio frequency components occupy the remaining top space of the chassis. The power transformer is most conveniently mounted on a small block of wood approximately 3x4x¾ inches.

If a larger chassis were to be used the transformer could be mounted with the balance of the transmitter.

The controls seen on the leading edge of the chassis are, from left to right, the tuning indicator light, the meter-key jack, and the plate tuning condenser. The antenna terminals are two *Eby* binding posts with insulated bases and shoulder washers to prevent short circuiting to the metal chassis. The tuning coils are *National* plug-in units, type AR-16. A *National* XB-16 socket mounts on the chassis top on stand-off insulators. By changing crystals and the plug-in coils, bands are selected. No "transmit-standby" switch is necessary for this rig since the 6V6GT oscillator tube draws current and goes into oscillation only when a meter or key is plugged into the jack. After the wiring has been completed and checked, the rig is ready to be tuned and put on the air.

The major reason for tuning up a transmitter is the same as when you connect the voice coil of a loudspeaker to the 8 ohm winding of an amplifier output transformer—to match impedances and gain a maximum transfer of power from one unit to the other. In the case of tuning up this little rig, you want to get a maximum of the power generated by the oscillator into the antenna. Your choice of the type of antenna depends entirely on your location, apartment, home, surrounding objects, or how high up-in-the-air you can get it.



Courtesy of P. R. Mallory & Co.

Fig. 2. Relationship between the capacitances, load current of the oscillator tube, and the output voltage of the rig.

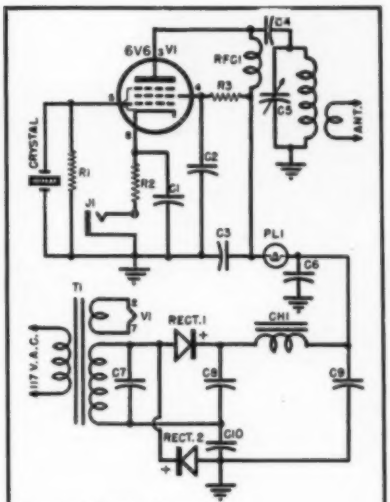
As with most things, the most desirable antenna design is the simplest one you can construct that is consistent with reasonable performance. I recommend either one of these two well known types, the folded doublet and the 2-band end-fed wire.

A One Band Antenna

If one band operation is desired, the antenna shown in Fig. 4, the half-wave doublet, has been in satisfactory use for years and years. Many commercial FM and TV, as well as commercial communication and ham stations, use this basic antenna design. It's quite easy to figure out the necessary length of wire to match the particular crystal frequency at which you are operating. For example, you want to operate on 40 meters and your crystal frequency is 7150 kc., the middle of the band. Follow these steps and you can cut the antenna wire to the length necessary to resonate with any ham crystal. In the formula: $L = 468/f$ substitute the crystal frequency in megacycles for f. L then becomes the length of the antenna in feet. In this case $L = 468/7.15$ or 65.45 feet.

For practical wire cutting purposes, 65½ feet is close enough. As shown in Fig. 4, split the 65½ feet long wire at the midway point and trim 6 inches off each end of the two wires. Then, as in the diagram, form an insulated splice to join the two wires together. This is done by using two non-conducting antenna insulators and another short piece of wire between them, so measured that the entire splice section

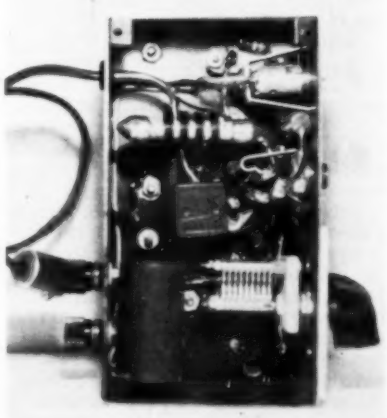
(*Continued on page* 133)



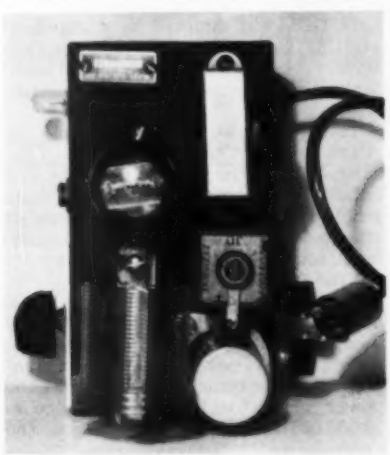
R_1—47,000 ohm, ½ w. res.
R_2—270 ohm, 1 w. res.
R_3—10,000 ohm, 1 w. res.
C_1—.002 μfd., 400 v. cond.
C_2, C_3, C_4, C_6, C_7—.005 μfd., 400 v. cond.
C_5—50 μμfd. midget var. cond.
C_8, C_{10}—20 μfd., 150 v. elec. cond.
C_9—20 μfd., 350 v. elec. cond.
CH_1—30 ma. filter choke, approx. 8 hys.
RFC_1—2½ mh. r.f. choke
J_1—Open circuit jack
Crystal—Trans. crystal for ham band, 40, 80, or 160 m.
Final tank coil—Plug-in coil and receptacle to match crystal frequency (National AR-16)
PL_1—#47 6-8 volt, 150 ma. pilot light
Rect.$_1$, Rect.$_2$—75 ma. selenium rectifier
T_1—Half-wave trans. 117 v. @ 50 ma. sec.; 6.3 v. @ 1.5 amp. sec. (Merit P-3045)

Fig. 3. Complete circuit diagram of the compact, 12-watt transmitter which can be built on a 3x5x1¾-inch chassis.

Bottom view of the transmitter chassis. Although the chassis measures just 3x 5x1¾ inches there is a surprising amount of space available even after all of the parts have been wired into place.



Top view of rig shows efficient use of small space. In a line down the side are the filter choke, two selenium rectifiers, and the electrolytics. The crystal, tube, and coil are also visible in this photo.



Practical SOUND ENGINEERING

By

H. M. TREMAINE, D.Sc.

College of Audio Engineering
University of Hollywood

Part 3. The decibel—its definition and how it is used as a convenient tool by the design engineer to calculate gains and losses in audio equipment.

IN THE field of acoustics and sound engineering, the range of sound intensities or pressures is so great that it has been found necessary to establish a standard scale of units by which they might be gauged. As the human ear hears in a logarithmic manner, it was necessary for the scale of units to be a logarithmic function.

At an international convention of telephone engineers and other interested persons held in 1938, the "bel," so-called in honor of Alexander Graham Bell, was adopted as a standard unit of measurement, replacing the former "transmission unit" (tu.) used for the measurement of sound intensities.

The bel is equal to the common logarithmic ratio of two powers. When the ratio is 10/1, the powers differ by one bel. The decibel is the unit generally employed to express the magnitude of changes in sound intensity or signal level, and is 1/10 of a bel. The symbol for the decibel is db.

The decibel is most useful in audio design work and audio frequency measurements. In audio engineering large power ratios are reduced to numbers more convenient to handle. If the power at the output of a device is 10,000,000 times that at the input, the ratio is expressed simply as 70 db. Gain and loss may be added or subtracted directly. In acoustic measurements, the decibel is used to express a change in the intensity level. The change in level can be expressed either in decibels or "volume units". A change of 1 volume unit (vu.) is equal to a change of 1 decibel. The term "volume unit" is generally used when speaking of complex waveforms comprising speech or music, or both. To use the decibel equation and its derivatives, a knowledge of logarithms is essential.

Logarithms are basically nothing more than an expanded system of powers of ten. The first step in taking the logarithm of a number is to express that number as a number between one and ten multiplied by the proper power of ten. Let us consider the number 278,000. This can be written as 2.78×10^5, and is as far as we go in a simple powers of ten operation, but in logarithms, we can go farther.

Let us now express the 2.78, also as a power of ten. Remembering that 10^0 is equal to 1 and that 10^1 is equal to 10, it is obvious that any number between 1 and 10 will have a corresponding power of ten between zero and one, and numbers between zero and one are decimals. The number 2.78 can be written as $10^{0.444}$ and, consequently, the entire number can also be written as $10^{0.444} \times 10^5$. In multiplying such numbers, we merely add exponents, which gives us $10^{5.444}$ as the power of ten corresponding to the number 278,000. To convert this to a log, we merely neglect to write ten; thus: $\log_{10}$ 278,000 equals 5.444.

A logarithm is divided into two parts, the whole number (in this case 5) and the decimal part (.444). The whole number is called the "characteristic," and the decimal part the "mantissa." Observe that the characteristic is the power of ten used to express the original number as a number between one and ten, and the mantissa is the power of ten corresponding to the number as it was written. Mantissas are always decimals, and are obtained from a log table.

The characteristic is never printed in the log table, nor is it read on a slide rule. The characteristic is determined by the number of digits, *i.e.*, 0=units, 1=tens, 2=hundreds, 3=thousands, 4=ten thousands, 5=hundred thousands, 6=millions, 7=ten millions, 8=hundred millions, and 9=billions.

When a number is between 1 and 10, the characteristic is zero, because it will be between 10^0 and 10^1. We can find the characteristic by writing the number in units and applying powers of ten. In doing so, the exponent of the power of ten will be the characteristic.

For example: 765,000 would be written 7.65×10^5. Its characteristic would be 5 or, given the figure 0.000765, written in powers of ten, we would have 7.65×10^{-4} and the characteristic would be -4.

The characteristic may also be determined by the application of one of the following rules:

Rule One: For numbers greater than unity, the characteristic is one less than the number of digits to the left of the decimal point.

Example: Consider the number 34. This number has two digits to the left of the decimal point, therefore, the characteristic is 1. The number 340 has three digits to the left of the decimal point; hence, the characteristic would be 2, etc.

Rule Two: For numbers less than unity, the characteristic is negative and one more than the number of zeros between the decimal point and the first significant digit.

Example: Consider 0.0403. There is only one zero between the decimal point and the first significant figure. Hence, the characteristic would be $\bar{2}$. Or, if we were given the figure 0.000403, we have three zeros between the decimal point and the first significant figure and the characteristic would, therefore, be $\bar{4}$, one more than the number of zeros between the decimal point and the first significant figure.

As has been previously stated, the fractional part of the logarithm is called the mantissa. All mantissas are *positive*. When a log has a negative characteristic, it is written $\bar{3}$. The minus sign above the characteristic indicates that the characteristic and only the characteristic is negative. The mantissa, determined by the use of log tables, is always positive.

Thus far we have discussed the conversion of a number to a logarithm. We must now consider the conversion of a logarithm to a number, or an "antilog." When converting a log to a number, the first step is to read the mantissa from the log tables and then place the decimal point. The antilog is sometimes written as $\log^{-1}$, which simply means, antilog of the number. Suppose we were given the problem: $\log^{-1}$ 3.6990; find the number. Remember that the notation $\log^{-1}$ indicates that the figure or figures following it are already a logarithm and must not be further converted into a logarithm.

Referring to a log table, we find the mantissa 6990 under the "0" column and opposite the "N" column figure of 50. Thus we know our resultant figure will be 50 something. The characteristic of 3 tells us that the number will be greater than unity (see Rule One) and because it is 3, the number, then, must be FOUR places to the left of the decimal point, or 5000.

Suppose, however, that the problem had read $\log^{-1}$ 0.6990. The characteristic here is zero, indicating the number is greater than one and less than ten. The mantissa is the same, so we would arrive at the result that $\log^{-1}$ 0.6990 equals 5.0. Similarly, if the problem had read $\log^{-1}$ .6990 the result would be 0.05, since the characteristic of $\bar{2}$ indicates one more than the number of zeros between the decimal point and the first significant digit, or the position of the first significant figure to the right of the decimal point.

Use of Decibels

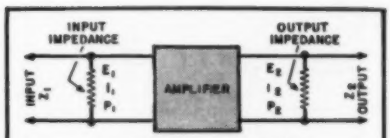
Gain is defined as an increase of power and may be expressed in decibels. A reduction in power is considered a *negative* gain, and is expressed in decibels as a loss. The decibel is used to express amplifier gain, variations in frequency response, power output, and the intensity of sounds. It is also used to express the loss of attenuators and the frequency characteristics of equalizers, filters, and similar equipment. Very often a reference level is used in conjunction with such measurements.

The two reference levels in current use are 1 milliwatt and 6 milliwatts. The first reference level is based on the flow of 1 milliwatt of power in a 600 ohm circuit. The second reference level is based on the flow of 6 milliwatts of power in a circuit resistance of 500 ohms.

Equipment manufactured since 1938 is designed and calibrated for the 1 milliwatt reference level. The 6 milliwatt reference level was in general use prior to 1938 and is still being used by the majority of the motion picture studios in Hollywood. The 6 milliwatt reference level was adopted in the early days of telephony as a standard because it represented the amount of power required for satisfactory reproduction by the telephone equipment then in use. A number of years ago *RCA* introduced a 12.5 milliwatt reference level, which was used by the broadcasting and recording industries; however, this was later replaced by the 6 milliwatt reference level.

With the 1 milliwatt reference level came a new term, "zero-dbm.", meaning that the power level under discussion is in relation to 1 milliwatt of power in a 600 ohm circuit. In the discussion of reference levels, the term dbm. applies *only* to the 1 milliwatt reference level, while the term db. is used *only* to express levels referring to the 6 milliwatt reference level.

The use of a 1 milliwatt reference level has its advantages. It is a unit quantity; hence, it is readily applicable to the decimal system, being related to the watt by a factor of 10^{-3}, which results in positive values for the majority of measurements.



TO FIND GAIN IN DB.

1. If Z_1 and Z_2 are equal

$$db. = 10 \log_{10} \frac{P_2}{P_1} = 20 \log_{10} \frac{E_2}{E_1}$$

$$= 20 \log_{10} \frac{I_2}{I_1}$$

2. If Z_1 and Z_2 are unequal

$$db. = 10 \log_{10} \frac{P_2}{P_1} = 20 \log_{10} \frac{E_2\sqrt{Z_1}}{E_1\sqrt{Z_2}}$$

$$= 20 \log_{10} \frac{E_2}{E_1} + 10 \log_{10} \frac{Z_1}{Z_2}$$

$$= 20 \log_{10} \frac{I_2\sqrt{Z_2}}{I_1\sqrt{Z_1}}$$

$$= 20 \log_{10} \frac{I_2}{I_1} + 10 \log_{10} \frac{Z_2}{Z_1}$$

Fig. 1. Amplifier circuit and the formulas used to determine the gain of amplifier.

When speaking of quantities above the reference level, it is said to be "*n*" db. *above*, and then referring to levels below, "*n*" db. *below*.

The gain of an amplifier is positive because it amplifies the signal and increases its amplitude. Other devices, such as mixer networks, filters, equalizers, and attenuators all produce a loss when inserted in a circuit, and result in a reduction of power at their outputs.

In the general decibel equation, we make use of a ratio between two powers, one of which may be a fixed reference level. In the calculation of gain or loss, the power at the output of a device is compared to the power at its input. When the decibel is used in this sense, there is no fixed reference level.

The second most common application of the decibel is the expression of power at some point in a system. The equation for this expression requires the use of two powers and their ratios. For the second power we use the standard reference level, and state it along with the level in decibels.

If it is stated that the level at some

Table 1. How widely divergent ratios may be calculated by inspection.

RATIO	$\log_{10}$ of RATIO	DB. for POWER RATIO	DB. for I or E RATIO
.0001	−4	−40	−80
.001	−3	−30	−60
.01	−2	−20	−40
.1	−1	−10	−20
1.	0	0	0
10.	1	10	20
100.	2	20	40
1000.	3	30	60
10000.	4	40	80
100000.	5	50	100
1000000.	6	60	120

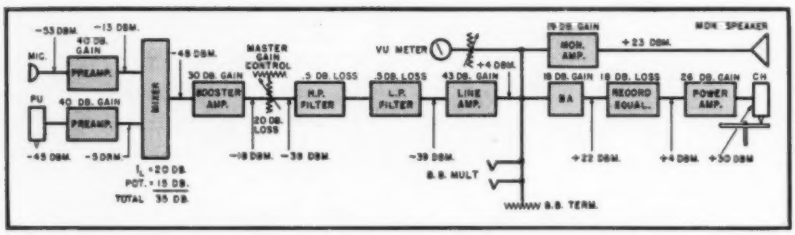


Fig. 2. Block diagram of a recording system illustrating range of levels encountered.

point in a recording system is plus 30 db., it means that the power at that point is 30 db. above the reference level, and expresses the power at that point with respect to the reference level.

A db. gain or loss may be used to express the ratio between the output and the input power of a device, and is indicative of the amount of amplification or loss in power of the signal, after passing through the device. This ratio is expressed by multiplying the logarithm of the power ratio by 10.

Amplifier gain is always stated simply as "*n*" db. gain. Quantities expressed in decibels may be added or subtracted, but never multiplied. Thus, if two amplifiers of 20 db. gain are connected in cascade or tandem, the total gain for the two is 40 db.

To prevent confusion as to which reference level has been employed in the rating of equipment, we express the power level in "db." for the 6 milliwatt reference level, and for the 1 milliwatt level, we use the term "dbm." (the *m* meaning milliwatt), to remind us that the statement is with respect to the 1 milliwatt reference level. The method of calculation is the same when using either reference level, except for the powers.

It is frequently of interest to know the voltage in a circuit represented by these reference levels. The voltage may be determined by the use of equation (1).

$$E = \sqrt{PZ} \quad \ldots\ldots\ldots\ldots \quad (1)$$

where: P equals the power in watts and Z the circuit impedance, in ohms.

Using equation (1) we find that the voltage for 1 milliwatt of power in a 600 ohm circuit is 0.773 volt and for 6 milliwatts in a 500 ohm circuit 1.73 volts.

For power levels expressed in db. and dbm. there is a *fixed* relationship between the levels. It is obvious that, for a given amount of power, the numerical value of db. will be greater for the 1 milliwatt reference level than for the 6 milliwatt reference level. This difference is 7.78 db. Therefore, a plus 10 db. is equivalent to a plus 17.78 dbm. This difference between the reference powers may be found by equation (2).

$$db. = 10 \log_{10} \frac{P_1}{P_2} \quad \ldots\ldots\ldots \quad (2)$$

Substituting in equation (2);

$$= 10 \log_{10} \frac{6}{1} = 6$$

$$10 \log_{10} 6 = 10 \times 0.778 = 7.78\ db.$$

This same equation may also be used to find the output level of an amplifier in db., although the output level is quoted in watts. As an example: assume we have an amplifier which is stated to have an output power of 10 watts. What is the equivalent in dbm.? Using equation (2) and the 1 milliwatt reference level:

$$db. = 10 \log_{10} \frac{P_1}{P_2}$$

$$= 10 \log_{10} \frac{10}{0.001} = 10{,}000$$

$$10 \times \log 10{,}000 = 10 \times 4 = 40\ dbm.$$

Because this represents a power greater than the reference level, we place a plus sign in front of the 40, thus the output level is plus 40 dbm. If the output was taken with respect to the 6 milliwatt reference level, the output would be a plus 32.22 db. It is now easy to see how an amplifier rated in db. could be very easily overloaded if an attempt were made to obtain an output level equivalent to that for the 1 milliwatt reference level. It is important to remember that every time the output level is increased 3 db., the output power must be doubled.

In both the examples thus far the greater power was placed in the numerator; naturally, the result will always be greater than unity, and the characteristic of the log will be zero or a plus quantity. In this way negative characteristics are avoided. Since it is known if the device has a gain or loss, it is only necessary to place the proper sign before the resulting answer.

When two values of voltage or current are to be compared, the logarithm is multiplied by 20 instead of 10, as the power varies directly as the square of the current. Doubling the log is equivalent to squaring the number. Therefore, for problems involving current or voltage, the equations (3) and (4) are used.

$$db. = 20 \log_{10} \frac{E_2}{E_1} \quad \ldots\ldots\ldots \quad (3)$$

$$db. = 20 \log_{10} \frac{I_2}{I_1} \quad \ldots\ldots\ldots \quad (4)$$

where: E_1 equals the input voltage and E_2 the output voltage and I_1 and I_2, the input and output currents.

One precaution must be observed when using equations (3) and (4); they may *only* be used when the input and output impedances are equal in value. If the impedances are unequal in value, equations (5) and (6) are substituted.

$$db. = 20 \log_{10} \frac{E_2 \sqrt{Z_1}}{E_1 \sqrt{Z_2}} \quad \ldots\ldots\ldots \quad (5)$$

$$db. = 20 \log_{10} \frac{I_2 \sqrt{Z_2}}{I_1 \sqrt{Z_1}} \quad \ldots\ldots\ldots \quad (6)$$

A typical example of how the gain of an amplifier with unequal input and output impedances is calculated, is given below using equation (5). Assume we have an amplifier with an input impedance of 250 ohms, and an output impedance of 500 ohms. The signal voltage at the input is 0.005 volt and the signal voltage at the output is 5.0 volts. What is the gain in db.?

$$db. = 20 \log_{10} \frac{E_2 \sqrt{Z_1}}{E_1 \sqrt{Z_2}}$$

$$= 20 \log_{10} \frac{5 \times \sqrt{250}}{5 \times 10^{-3} \times \sqrt{500}}$$

$$20 \log_{10} \frac{5 \times 15.8}{5 \times 10^{-3} \times 22.4} = \frac{79.0}{112 \times 10^{-3}}$$

$$= 20 \log_{10} 705 = 20 \times 2.8482$$

$$= 56.96\ db.$$

A problem that often arises in the design of audio amplifiers is: What will be the effective increase or decrease in the gain of an amplifier using an input transformer with an impedance ratio of 500 to 100,000 ohms, as compared to a transformer with an impedance ratio of 500 to 60,000 ohms, for the same level input signal.

First, we must know the turns ratio of the transformers. Turns ratio is equal to the square root of the impedance ratio. For the first transformer:

$$Turns\ Ratio = \sqrt{100{,}000/500} = \sqrt{200} = 14.14$$

For the second transformer:

$$Turns\ Ratio = \sqrt{60{,}000/500} = \sqrt{120} = 10.95$$

Substituting in equation (3);

$$db. = 20 \log_{10} \frac{14.14}{10.95} = 1.292$$

$$20 \times \log_{10} 1.292 = 20 \times 0.111 = 2.22\ db.$$

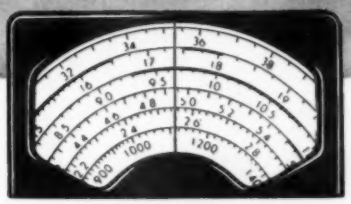
Therefore, if we substitute the second transformer and match the input

(*Continued on page* 143)

Table 2. Gains and losses in a sound system and how they are added to attain over-all gain.

LOSSES		GAINS			
Mixer	35 db.	Misc. preamp	40 db.		
Master gain	20 db.	Booster ampl.	30 db.	Total gain	157 db.
Filters	1 db.	Line ampl.	43 db.	Total loss	74 db.
Rec. equal	18 db.	Bridg. ampl.	18 db.		
		Rec. ampl.	26 db.	NET GAIN	83 db.
Total loss	74 db.	Total gain	157 db.		

International SHORT-WAVE



***Compiled by* KENNETH R. BOORD**

THIS month it is a pleasure to dedicate the *ISW DEPARTMENT* to stations in widely-separated corners of the earth—namely, ELBC, Monrovia, Liberia, in Africa, and YNDG, Leon, Nicaragua, in Central America.

This information concerning ELBC came direct from Dr. John B. West, president, the Liberian Broadcasting Company, Monrovia, Liberia, which is the QRA for reports.

ELBC, the initial outlet of the Liberian Broadcasting Company, went on the air from its studios in Monrovia on May 2, 1950, transmitting with 1 kw., using a folded dipole antenna, on 6.025. The station broadcasts each night at 1945-2345 GMT (1445-1845 EST). Program material consists of popular, classical, folk, and children's music, children's stories, dramatic presentations, news and advertisements in *English;* and music, news, and advertising in Arabic and French.

Personnel includes a radio engineer, two radio technicians, two *English*-speaking announcers, an Arabic-speaking announcer, and a French-speaking announcer, as well as a musical librarian and stenographic help.

One of the most popular programs of ELBC is at 1515-1545 EST under the title "Children's Corner, with Uncle John;" another is "Listeners' Choice," directed by disc-jockey Richard Prees, at 1745-1845 each Saturday evening. The children's program is daily and includes music, education, and folk tales, as well as other famous types of children's stories of educational value.

At present, ELBC transmits for the "Voice of America;" *Sears, Roebuck and Company* of Philadelphia, Pennsylvania, and *RCA International* of the United States, and for such local (Liberian) firms as *National Manufacturing Company* and *National Drug Company*. Negotiations are in progress with 11 other American firms for advertising contracts, and with six firms in Great Britain.

"We will readily verify any correct logs reported to us in writing," says Dr. West, "and will reply negatively in writing to those that are incorrect. We will pay the postage."

At the time this was compiled, plans were being drawn for a *new* studio-transmitter building to house two *new* transmitters on shipment to Liberia. Each of the new transmitters is 1 kw. and will be coupled with new high-fidelity audio equipment and studio console. One will be used with a North-South high-gain directional antenna, and the other on a similar East-West antenna. The present transmitter will continue on a non-directional basis for radial coverage of the immediate surrounding area. New frequencies were yet to be assigned by the Liberian Chief of Communications, but will be in the 25- and 19-m. bands, respectively. *By this time the new transmitters may be in operation. I hope to have further details soon.*

ELBC also was drafting plans for "Learn English by Radio" which will carry education to the hinterland of Liberia; this probably will be effected in July or August of this year, and will be radiated during (local) daytime.

Just recently, ELBC has been coming through fair to good in the United States, probably due to more favorable seasonal propagation conditions approaching the optimum between Liberia and this country, and/or recently-effected improvement of coupling the transmitter to the antenna. Reception here in West Virginia normally is best towards closedown (1845 EST which is 2300 Liberian Time), and signal strength, quality, and QRM vary from day to day. Frequent announcements are noted and the station is easy to identify.

And direct from Dennis E. Gallo, manager, D. E. Gallo & Co., operator of Radio Colonial, YNDG, 5.995, Leon, Nicaragua, comes this interesting data:

YNDG began operations on April 1, 1938, on a frequency of 7.660 in the 39-meter band. Power was 100 watts, using a 35T on final, modulating with a pair of TZ20's. In 1947, the present rig—a *Hallicrafters* BC-610 E—was bought from the U.S. Government. It is a 250 watt transmitter. In February 1950, power was increased to 1 kw., using a new final with two 250TH tubes and a new power supply with two 866 tubes using 2400 volts and 350 mils on final. The old final of the rig, a 250TH, is a driver now with 60 mils; 100 mils on grid of final, also a new modulator transformer was installed to take care of the increased power.

On January 1, 1951, a new frequency was assigned by the Nicaraguan government—5.995. YNDG is on the air daily 1700-2300.

(*Continued on page* 110)

(Note: Unless otherwise indicated, all time is expressed in American EST: add 5 hours for GCT. "News" refers to newscasts in the English language. In order to avoid confusion, the 24 hour clock has been used in designating the times of broadcasts. The hours from midnight until noon are shown as 0000 to 1200 while from 1 p.m. to midnight are shown as 1300 to 2400.) The symbol "V" following a listed frequency indicates "varying." The station may operate either above or below the frequency given. "A" means frequency is approximate.

YNDG, 5.995, Radio Colonial, Leon, Nicaragua, uses a Hallicrafters BC-610E. Since this photograph was taken the station's power has been increased to 1 kw. and additional equipment has been added. Dennis E. Gallo is the manager of this outlet.

Adapt Your Amplifier for MAGNETIC RECORDING

By
LLOYD B. HUST

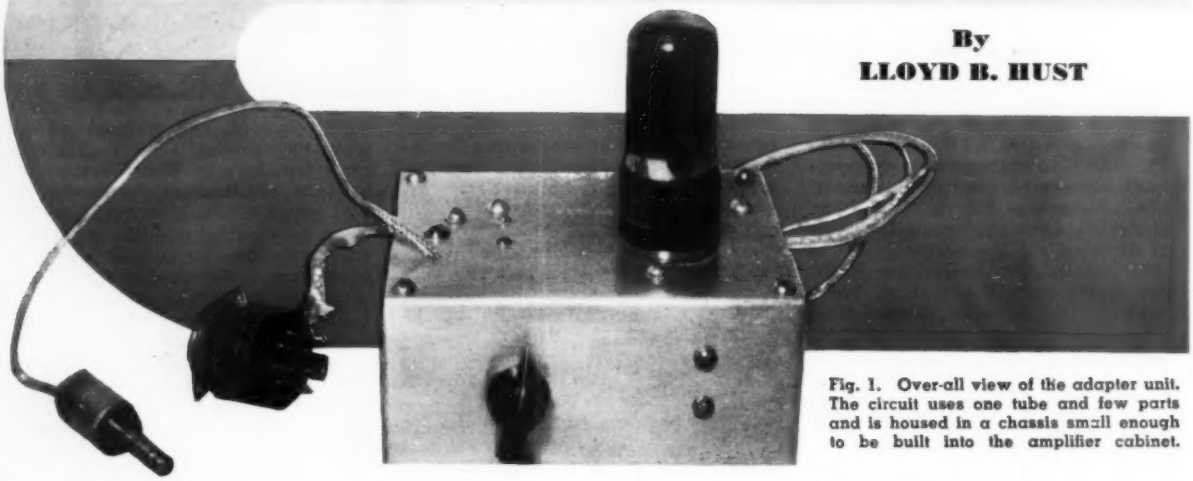


Fig. 1. Over-all view of the adapter unit. The circuit uses one tube and few parts and is housed in a chassis small enough to be built into the amplifier cabinet.

Construction details on an ultrasonic oscillator that can be used with your audio amplifier for recording and erasing on magnetic tape or wire.

IT IS a well-known fact that the ordinary amplifier is not suitable for magnetic recording unless it is especially adapted for this service. In fact, early experiments in magnetic recording were discontinued because, although magnetic impressions could be placed on the recording medium by feeding the output from a standard amplifier into an electromagnetic type of recording head, the recorded signal was of low amplitude, low signal-to-noise ratio, and of extremely high distortion. One reason for this is the non-linear relationship which exists between a constant-current recording signal and the magnetization characteristics of the permanent magnetic recording material. Experiments showed that the application of a d.c. bias voltage to the recording medium during recording would somewhat improve the amplitude and quality of the recorded signal, but the problem of low signal-to-noise ratio remained. The substitution of an ultrasonic a.c. bias for the d.c. bias helped greatly to overcome this difficulty. This mixing of this ultrasonic frequency with the audio signal being recorded usually takes place in the recording head, with both voltages being fed into the head simultaneously.

If the audio signal from an ordinary amplifier is fed into a recording head along with an alternating voltage of from 25 to 50 kc., the signal impressed upon the recording medium, be it tape or wire, will result in a magnetic pattern, which, upon playback through the same amplifier will result in a frequency response curve somewhat similar to that shown in Fig. 2. It will be seen from this curve, that for maximum fidelity, or for a "flat" recording and playback characteristic, the recording and/or playback amplifiers must be equalized at both the high and low frequency ends of the audio spectrum. Probably the most efficient method of equalizing to achieve a relatively flat response in magnetic recordings is to pre-emphasize the high frequencies and to post-emphasize the low frequencies, or possibly even both high and low frequencies. This method minimizes the possibility of over-recording or overloading the medium which would be likely to occur if the low frequencies were boosted during the recording cycle.

The modern recording amplifier, therefore, differs from the ordinary amplifier principally in two respects; first, in the incorporation of a source of high frequency bias current, and second, in the provision of equalization networks—high boost circuits for the recording cycle and high and low boost circuits for the playback cycle. Often this amplifier will also supply an ultrasonic voltage suitable for erasing a previously recorded signal.

Many experimenters would like to use their present amplifiers for magnetic recording. The adapter herein described will make this possible at a minimum of cost and with no internal changes required in the amplifier. The adapter is essentially an oscillator capable of supplying the necessary ultrasonic bias for recording and erasing of recorded signals. It is so constructed that it can be connected to the amplifier or disconnected in just a few moments. A switch is incorporated to connect the proper portion of the amplifier to the recording head and to disconnect the plate voltage from the oscillator tube while a record is being played so that the signal will not be erased. A separate switch is used to disconnect the lead from the plate of the amplifier when playing back a recording so that regenerative feedback will not occur.

This unit will work well with most of the high impedance heads now on the market. The erase voltage developed by this unit is sufficient to energize most low impedance erase heads. Very good results were obtained using the adapter with a *Shure* Model 815 head designed for tape recording. This head is a combination record-playback and erase head. The constructor may wish to use some other head, however, and any high impedance recording head will work well with this unit. A low impedance recording head will also work well, but in case such a head is used, the voltage from L_1 will have to supply the head with its bias voltage and the audio voltage will have to come from the secondary of the output transformer used in the amplifier. The fact that this unit can be used with practically any kind of head makes it a very versatile device.

The schematic diagram for the adapter is shown in Fig. 4. The oscillator coil L_1 and L_2 should be con-

structed as follows: The first half of L_1 —100 turns of #25 enameled wire—is layer wound upon a form ½" in diameter and 2½" long. (1¾" of this length is taken up by the actual windings) The ends of the form should be equipped with fiber washers so that the coil, when finished, will be as nearly cylindrical as possible. L_2 is wound directly over the first half of L_1 and is insulated from it by a layer of varnished cambric. (Heavy waxed paper will be suitable if the cambric is unavailable.) L_2 consists of 1000 turns of #30 enameled single cotton-covered wire and is tapped at the 275th turn. It may be difficult to wind this coil in even layers and "scramble" winding will be satisfactory if the coil is kept as cylindrical as possible. This winding should be covered with an insulating layer and the second half of L_1 is wound over it. This consists of another 100 turns of #25 enameled wire. The starting end of the second half of L_1 is connected to the finish end of the first half and both halves should be wound in the same direction.

The chassis used should be deep enough to house the coil and other components and a bottom plate should be employed to minimize radiation. (The chassis used by the author measured 4"x5"x2" deep). If these precautions are not taken, harmonics of the output of the oscillator may beat against the station carrier wave in an associated radio set, creating undesirable interference.

Pin jacks are used to connect the wires from the record-playback head and the erase head (or sections of the same head). Shielded wire is used and the connectors should make positive contact with their sockets. The lead to the input of the amplifier should be shielded and should be equipped with a connector which will fit the microphone input of the amplifier used. The lead to the plate of the output tube *must* be shielded or much difficulty will ensue. In general these leads should be kept as short as possible.

The connections to the amplifier, which are made to supply filament and plate power as well as to supply the audio voltage to the adapter, are made through a plug-socket connector which is plugged into the socket of one of the output tubes of the amplifier and into which the amplifier output tube is plugged. Fig. 3 shows how this connector is assembled from the base of an octal tube and an octal socket. A ⅜" hole is drilled in the side of the tube base and the leads from the oscillator are taken through this hole. They are soldered to the appropriate socket pins —filament leads to pins 2 and 7, plate lead to pin 3, "B+" lead to pin 4. Then a flexible lead is made from each socket terminal to the corresponding pin in the tube base. The connections indicated are for the beam power type of tube, such as 6V6 or 6L6 with which most amplifiers are equipped. If the amplifier to be used does not use this type of output tube, it may be necessary to wire in a special connector to the amplifier so that the proper voltages can be obtained. The "B—" lead and the shield on the wire connecting to the plate of the output tube should be connected to the amplifier chassis with a clip.

Since different amplifiers may have different voltages present at the output tubes, the value of R_2 may have to be changed to compensate for this difference. The voltage at the plate of the 6V6 should be in the neighborhood of 275, although the value is not critical. In order to develop sufficient voltage for some erase heads it may be necessary to raise this voltage some. Raising it above 300 volts will have a tendency to cause the oscillator to deliver a distorted wave rather than the true sine wave which is necessary if distortion-free recordings are to be obtained.

The record-playback head receives its audio voltage directly from the plate of the output tube of the amplifier through a .25 μfd., 600 volt condenser in series with a 25,000 ohm, ½ watt resistor. The return lead of this head is to ground. The bias voltage is fed into this head through a 150 μμfd. mica condenser directly from the plate of the oscillator tube. The erase head receives its voltage from the secondary winding (L_3) of the oscillator coil.

Probably the most difficult problem in the construction of this unit is that of eliminating any regenerative feedback from the output to the input of the amplifier. This problem is brought about because it is necessary to bring the output and input leads fairly close together so that the proper circuit can be switched into the record-playback head. The switch S_2 is not a part of the rotary switch S_1 because of the possibility of feedback. S_2 is a toggle switch which is located as shown in the diagram of the chassis. This arrangement minimizes the likelihood of feedback.

The condenser C_6 resonates with the head when it is used for playback. This gives the necessary high boost.

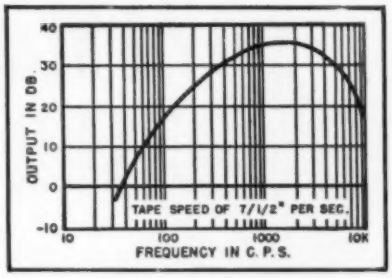
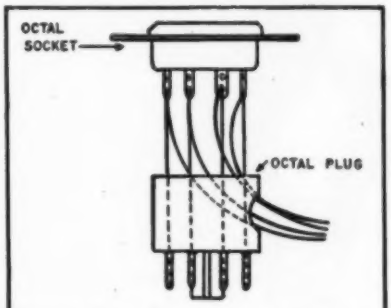


Fig. 2. Unequalized response of magnetic tape.



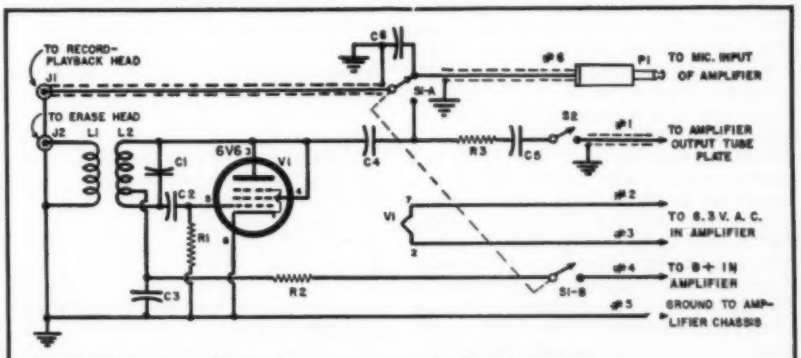
Connect all 8-socket terminals to corresponding plug pins.
Lead Connections: Pins 2 and 7 to fils. of osc. tube.
Pin 3 to shielded lead #1 (Fig. 4).
Pin 4 to "B+" lead (#4 in Fig. 4).

Fig. 3. Construction of plug-socket unit.

The value of this condenser varies with individual heads, and will range from .002 to .01 μfd. However, a condenser of .005 μfd. will give good results with most heads. For best high frequency boost, different values for C_6 should be tried. In order to eliminate any changes in the amplifier being used, no other equalizing circuits are shown. Since most amplifiers are equipped with tone controls, the proper use of these controls will enable the operator to record and play back a signal with it flat over a wide

(*Continued on page* 118)

Fig. 4. Complete schematic diagram and parts list for the magnetic recording adapter.



R_1—25,000 ohm, 5 w. wirewound res.
R_2—10,000 ohm, 5 w. wirewound res.
R_3—25,000 ohm, ½ w. res.
C_1—500 μμfd. mica cond.
C_2—.01 μfd., 600 v. cond.
C_3—10 μfd., 450 v. elec. cond.
C_4—150 μμfd. mica cond.
C_5—.25 μfd., 600 v. cond.
C_6—.002 to .01 μfd., 400 v. cond. (see text)

S_1—D.p.d.t. rotary sw.
S_2—S.p.s.t. toggle sw.
L_1, L_2—Osc. coil (see text)
J_1, J_2—Microphone jack
P_1—Plug to fit amplifier mike input
V_1—6V6GT tube
Plug-socket connector is built up from an octal socket and base from an octal tube. See text and Fig. 3.

Mac's RADIO SERVICE SHOP

By JOHN T. FRYE

PICKUP POINTERS

"HEY, Chief," Barney called to Mac, "bend an ear to this sour-sounding combo, will you? Seems all okay on the radio, but it's strictly from hunger on the platters. Suppose it could be the crystal cartridge? I checked the output of the pickup with the v.t.v.m., and it peaks right up to the rated two-and-a-half volts, without any jerking of the meter pointer like you get with a cracked crystal; but just listen to the awful things it is doing to the voice of 'liltin' Martha Tilton.'"

Mac lifted the tone arm from the record and looked at the crystal; then he sauntered to the back of the radio and record-player combination and took a long look at the wiring at the rear of the chassis.

"The equipment is all right," he said, "but the outfit is suffering from what guys in the service call 'cockpit trouble,' meaning 'fouled up by the operator.' Originally that tone-arm carried a beam-of-light pickup system, and the very low output of the light cell was amplified by a high-gain amplifier running wide open. During the war it became impossible to get light cell replacements, and a technician has changed this one over to a crystal cartridge. The idea is good, but the method is wrong. The full output of the crystal cartridge is run straight into the amplifier, feeding it ten or twenty times as much signal as it was designed to handle. The result is the heavy overloading and distortion that you hear."

"Well, what's to do about it?"

Before answering, Mac slid a drawer out of a steel filing cabinet and riffled through the index cards. Then he pulled out a mimeographed sheet and sailed it across to Barney. "Rewire the phono and microphone inputs according to this diagram," he told the youth. "That attenuator network (see Fig. 1) will make the pickup do justice to Martha's voice."

Barney looked at his employer quizzically. "I'm wondering how it always 'just happens' that you have the information on tap for licking nearly every problem I bring up," he said slowly. "For instance, how did you come by this diagram?"

"Elementary, my dear Watson," Mac replied cheerfully; "I sent for it. You may have noticed that I study radio magazines, house organs, advertising pamphlets, etc. received here at the shop almost as thoroughly as you go over *Esquire* cartoons. When I see a manufacturer is offering an informative brochure on some subject in connection with radio or television, I send for it, read it, and file it away for future reference. On top of that, when I run across something that puzzles me in service work and which I cannot answer by myself, I don't hesitate to call for help by writing to the company that made the puzzling gadget. You'd be surprised how much time and trouble a big manufacturer will go to in order to help you do a better service job on his products. That cabinet is stuffed with letters from company engineers."

"While I'm changing over this pickup, and while my mind is on the subject, why don't you go through that file and give me some more good hot dope on the phonograph cartridges," Barney suggested.

"Okay," Mac agreed as he pulled a fat file from the cabinet; "but just remember you asked for it. For instance, did you know that a Rochelle salt crystal cartridge has its greatest output at 70 degrees, Fahrenheit, and that will function normally and have a very long life under temperature and humidity conditions most comfortable to human beings? Seventy to eighty degrees and a relative humidity of fifty per-cent is just right for people and crystal cartridges."

"The tropics must be kind of hard on the cartridges," Barney's muffled voice said as he lay on his back with his head inside the speaker compartment of the combination.

"They are. In the daytime tropical temperature and humidity are both high. At night the temperature may drop 50 degrees while the relative humidity remains high. The effect on the hygroscopic cartridge is to make it practically suck water into itself. The moisture lowers the resistance of the crystal element, causing a reduction in output and a change in frequency response most noticeable as a loss of low frequencies. Eventually, enough moisture will ruin the crystal either by dissolving it or by promoting fungus growth that accomplishes the same end."

"Any way of licking the problem?" Barney asked as he vigorously shook excess solder from the tip of his solder gun.

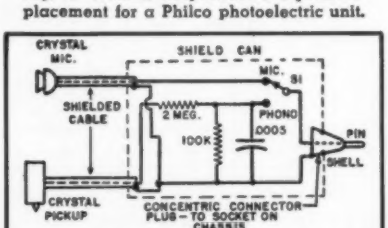
"There are some partial solutions. Crystal cartridge manufacturers use every known method to waterproof their products. Some of them make up special humidity-proofed units for use in the tropics. None of these measures, however, will completely prevent hydration; but they help a lot in slowing up the process and extending the life of the crystal.

"There are some things the cartridge-user can do to help. One thing is to keep a low-wattage bulb burning inside the radio cabinet near the crystal. This will keep the temperature fairly even and will dry some of the moisture from the atmosphere. The trick is to make sure the temperature of the crystal never goes above 110 degrees. The melting point of Rochelle salt is just slightly above 120 degrees, and the closer the cartridge is operated to this temperature, the shorter will be its life span.

"Another practical solution, especially with plug-in type cartridges, is

(*Continued on page* 99)

Fig. 1. Astatic Corporation's crystal replacement for a Philco photoelectric unit.



Note: Photocell transformer is not used. Concentric connector plug is taken from large shielded cable used to connect transformer to socket on chassis.

The values given in the circuit diagram provide the same frequency response as original photoelectric unit when Astatic LP-6 cartridge is used.

SQUARE-WAVE TESTING SPEEDS TV SERVICING

By LOUIS E. GARNER, JR.

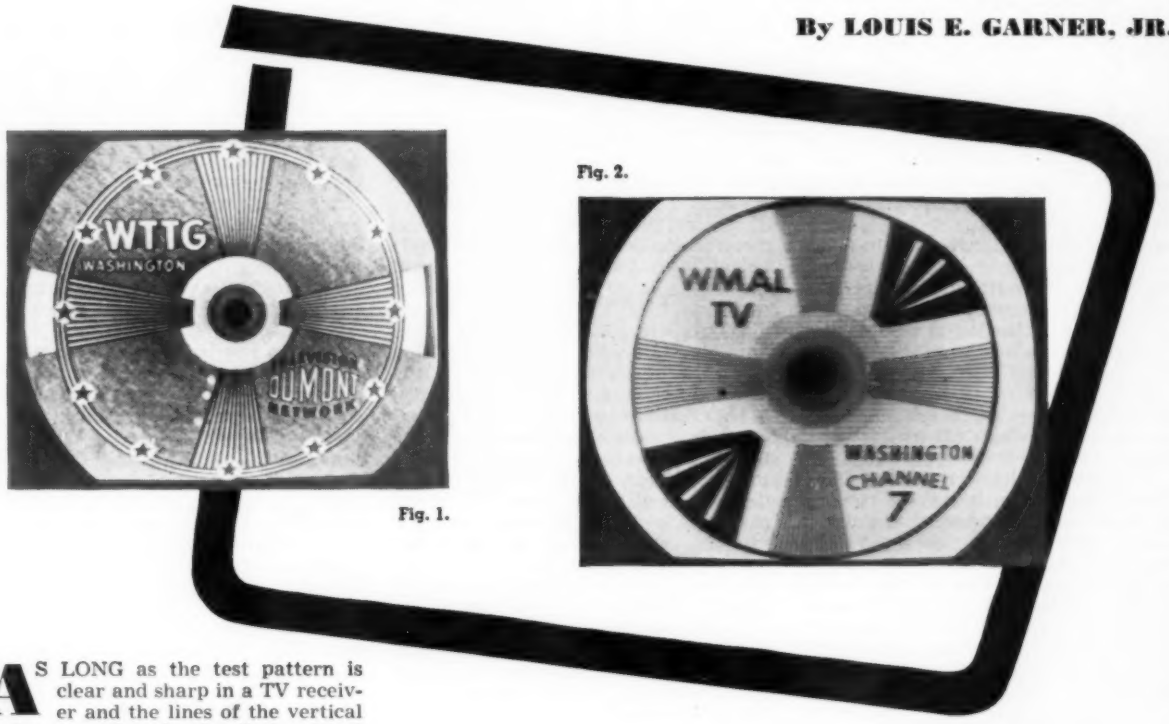


Fig. 1.

Fig. 2.

Not a new technique but one that will provide a faster and more accurate method of servicing.

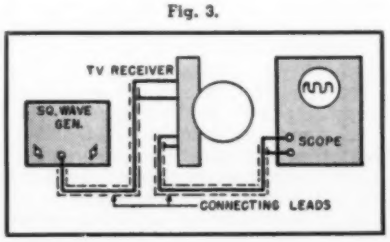
AS LONG as the test pattern is clear and sharp in a TV receiver and the lines of the vertical wedges can be clearly distinguished down to the center circle, it may be safely said that all signal circuits in the receiver are operating normally (see Fig. 1). If the picture quality deteriorates, the definition may suffer (Fig. 2) with the result that the lines "fade out" before reaching the central circle.

This condition (Fig. 2), may be caused either by defects in the video i.f. stages, or by defects in the video amplifier following the 2nd detector. The technician, upon encountering these conditions, may immediately assume that the trouble is in the video i.f., then spend from 30 minutes to an hour carefully realigning the i.f., only to find that the condition still exists. Or he may assume the trouble to be in the video amplifier, then spend considerable time trying substitute parts and checking plate and screen voltages in the video amplifier circuits.

However, by using a square-wave generator and easily applied test techniques, the average technician may, within only a *few minutes,* definitely find whether the trouble is in the video amplifier or not. He may then continue the same technique to isolate the trouble to a stage or part, or, if the video amplifier is shown to be clear of defects, concentrate on the video i.f. with full assurance he has isolated the trouble.

The basic connections necessary for the equipment used in applying this time-saving test technique are shown in block diagram form in Fig. 3. Actual connections are shown schematically in Fig. 4, where a part of the video amplifier circuit for the popular *RCA* 630TS TV receiver is used as an example. In practice, connections to and from the square-wave generator and to the cathode-ray oscilloscope are kept as short as possible. Open leads should be used unless shielded connections are necessary to minimize stray hum pick-up. If a "low-capacity" probe is available for the oscilloscope, this should definitely be employed to prevent undue capacity loading of the 2nd video amplifier stage.

Fig. 3.



Several square-wave generators are available and all are generally satisfactory for carrying out the test techniques to be described. The generator should, however, at least meet the following basic requirements:

1. It should be able to supply both low and high frequency square-wave signals (50 c.p.s., 1 kc., or 10 kc., 100 kc., and 500 kc. or 1 mc.).

2. The square-wave signals supplied should have short rise time (maximum tolerable for high frequency signals is .1 microsecond).

3. Low output impedance (not over 600 ohms).

4. Control over output. Should be able to adjust output from several volts to under 1 volt.

5. The signals supplied should be free from overshoots and tilt at all frequencies within its range.

Any standard cathode-ray oscillo-

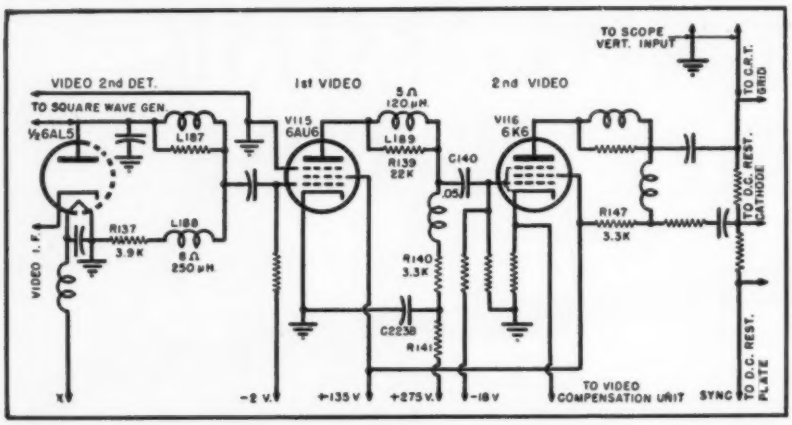


Fig. 4

scope may be used, provided it has good vertical response characteristics and has a sweep permitting at least two or three cycles of any of the square wave signals used in testing to be observed. For checking video amplifiers, the vertical amplifier of the scope should be reasonably flat (± 3 db.) to 5 mc., should be free of overshoots, and should not introduce tilt in a 50 c.p.s. square wave.

If you do not know the characteristics of your scope, it may be checked by connecting the square-wave generator directly to the vertical input terminals and observing high and low frequency signals. The square waves should retain their "perfect" form, should not exhibit overshoots, and should not be rounded or tilted at frequencies of 50 c.p.s. 10 kc., 100 kc., or 500 kc.

Square-Wave Testing

Square-wave testing techniques have been described briefly in an earlier article[1], and general information concerning analysis of the square-wave signals was given then. However, a brief review may be of value at this point.

Referring to Fig. 5A, a "perfect" square wave (3) may be considered to be made up of a sine wave (1), plus third (2) and higher odd harmonic signals, but of decreasing amplitude. The "body" of the square wave and its flat top are due primarily to the lower frequency signals, while the sharp leading and trailing edges are due to the higher frequency harmonics.

If there is a loss of lower frequency signals, or phase shift with respect to the higher frequency harmonics, the flat top of the square wave may be "tilted" and may even be concave as shown in Fig. 5B. A boost at frequencies near the fundamental of the square wave may result in a tilt in the opposite direction and in a convex top.

A loss of higher frequency signals results in "rounding" of the leading edges as in Fig. 5C, while accentuation or peaking at higher frequencies may result in damped oscillations and "overshoots" as in Fig. 5D.

Troubleshooting

To prepare the following data, the author used an *RCA* 630TS television receiver, a *Tektronix* type 105 square-wave generator, and a *Tektronix* Model 511AD cathode-ray oscilloscope. However, since video amplifiers used in different TV receivers are essentially of the same form, the data obtained may be considered general, and will serve as a guide when servicing any TV receiver. Similarly, any test equipment meeting the general specifications outlined will be suitable for carrying out the test technique.

Defects were actually introduced in the TV receiver to cause complaints similar to those illustrated in Fig. 2, but in varying degree. Square-wave test techniques were then applied, and the resulting waveforms carefully traced.

Normal: Before introducing any defects, square-wave signals of 50 c.p.s., 10 kc., 100 kc., and 500 kc. were introduced in the video amplifier and output waveforms observed, to obtain the "normal" response of the video amplifier (Fig. 4). The waveforms obtained are illustrated in Fig. 6 (A to D). A 50 c.p.s. signal was tilted slightly, as shown in Fig. 6A. The 10 kc. square wave (Fig. 6B) was almost "perfect" except for a slight overshoot and "wriggle" on the leading edge, indicating the effect of the peaking coils. This is shown further by the 100 kc. square wave and the 500 kc. square wave, Figs. 6C and 6D, respectively. At these frequencies, however, "rounding" appears due to the drop-off in high frequency response.

C_{223B} increased in capacity: A 10 μfd. electrolytic condenser was shunted across C_{223B}, (Fig. 4) doubling its effective capacity. No change occurred in the 10 kc., 100 kc., and 500 kc. signals. The 50 c.p.s. signal was tilted slightly more, but not appreciably. This simply indicated insufficient low-frequency compensation. Such a condition would probably not be noticed in the majority of TV receivers.

C_{223B} decreased in capacity: When C_{223B} was removed from the circuit and a .5 μfd. condenser substituted, simulating a decrease in capacity or a partially open condenser, it was again found that the 10 kc., 100 kc., and 500 kc. square-wave signals were not changed. However, the 50 c.p.s. signal was changed appreciably and appeared as in Fig. 6E. This indicates peaking at a low frequency, and would affect a picture by preventing rapid changes in shade over large areas of the picture. Thus a scene with a light background and dark foreground would appear as gray fading to light followed by gray fading to black rather than as sharp whites and blacks.

C_{223B} open: An open in C_{223B} was next shown by removing this condenser completely from the circuit. This effectively made R_{141} part of the plate load for the 6AU6. When this was done, it was found that the amplitude of the output signal became much higher for the same input and that a ripple appeared along the top of the 50 c.p.s. square wave, as shown in Fig. 6F. Apparently C_{223B} also serves to remove some hum and this appears superimposed on the square wave. The 10 kc. signal appeared normal, except that the slight "wriggle" on the leading edge disappeared. Both the 100 kc. and 500 kc. square waves were rounded, as shown in Figs. 6G and 6H, respectively, indicating a severe loss of higher frequency signals due to the increased plate load resistance of the 6AU6. As far as a picture is concerned, this defect would appear as a severe loss of high frequency definition (Fig. 2), together with faint 120 c.p.s. "hum bars" superimposed on the scene.

C_{139} changed to .01 μfd.: A partially open coupling condenser does not affect the 10 kc., 100 kc. or 500 kc. square-wave signals, but the tilt and concavity of the 50 c.p.s. signal increased as shown in Fig. 6I. Such a defect would affect a picture as shown in Fig. 2, but to a much greater degree. . . It would be completely blurred.

C_{139} changed to .0001 μfd.: When the coupling condenser becomes almost completely open, the 50 c.p.s. square wave is differentiated and appears as a pulse as shown in Fig. 6J, while phase shift even causes the 10 kc. square wave to become tilted as shown in Fig. 6K. Both the 100 kc. and 500 kc. square-wave signals remain unaffected, however. Such a defect would result in severe "smearing" of a reproduced picture.

L_{139} opened: An open peaking coil permits its damping resistor (R_{139}) to become part of the plate load resistance and to act as a voltage divider with the normal plate load resistor. As may be expected, the only effect of this defect on the 50 c.p.s. and 10 kc. square-wave signals is to reduce their amplitude. The 100 kc. and 500 kc. signals are rounded considerably, however, indicating a severe loss of high frequency components. Such a defect would result in a picture appearing as shown in Fig. 2. The 100 kc. and 500 kc. wave-

[1] Garner, Louis E., Jr.: "Wide Frequency Range Square-Wave Clipper," Radio & Television News, March, 1950.

forms are shown in Figs. 6L and 7A, respectively.

L_{138} shorted: With peaking coil L_{138} shorted, the 50 c.p.s. and 10 kc. signals are not affected, and the only effect on the 100 kc. square-wave signal is a slightly increased rounding of the leading edge, while the 500 kc. signal appears as shown in Fig. 7B. On a picture, this defect would result in a slight, but not severe, loss of definition.

R_{137} shorted: All square-wave signals are affected with this defect, for peaking coils L_{137} and L_{138} act almost alone as a load for the video 2nd detector. Almost all low frequency signals are lost, with a 50 c.p.s. signal appearing as a pulse as shown in Fig. 7C. The 10 kc. signal appears as shown in Fig. 7D, while the 100 kc. signal appears somewhat similar as shown in Fig. 7E. Finally, the 500 kc. signal appears as in Fig. 7F. The effect of this defect on the picture would likewise be severe. Smear would appear, indicative of poor low frequency response and phase shift, and duplicate pictures would appear to follow the image (similar to "ghosts"), indicative of the "ringing" which causes the ripples shown in the higher frequency square-wave signals.

R_{140} increased to 10,000 ohms: When the plate load resistor increases in value, low frequency response is generally unaffected, and a 50 c.p.s. square wave appears almost normal as shown in Fig. 7G. High frequency response of the video amplifier suffers, however, and the 100 kc. (Fig. 7H) and 500 kc. (Fig. 7I) are rounded appreciably. Such a defect would result in severe loss of high frequency definition, with the test pattern appearing somewhat as shown in Fig. 2.

R_{137} changed to 1000 ohms: In the final example, the plate load resistor for the 6K6 was changed from 3300 to 1000 ohms. It was found that the 50 c.p.s. square-wave signal was affected only as far as amplitude was concerned (somewhat lower in amplitude), but that severe overshoots and "ringing" occurred in all higher frequency square-wave signals. The 10 kc. square-wave signal is shown in Fig. 7J, while the 100 kc. and 500 kc. signals appear as shown in Figs. 7K and 7L, respectively. Such a defect, while not introducing "smear" (as did a short in R_{137}), does cause severe "ringing." Multiple images appear right alongside the main image as far as a picture is concerned, with each additional "image" represented by a peak in the oscillatory wavetrain appearing after the leading edges of the square-wave signals shown in Fig. 7 (J to L). It is generally possible to distinguish multiple images due to "ringing" from those due to "ghosts" by several important characteristics.

First, multiple images due to "ringing" only follow sharp changes in picture brightness, such as a change from black to white. On the other hand, "ghosts" are complete duplicate images. Secondly, where ringing occurs, several multiple images are formed, all of which are quite close together,

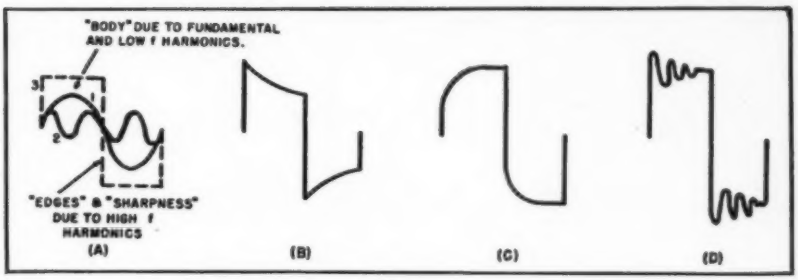


Fig. 5

and with about equal spacing. "Ghosts" may be unequally spaced with respect to one another and the main image, and are usually further apart. In addition, there are seldom more than one or two ghosts present, except in unusual locations.

Finally, the number and appearance of ghosts will generally vary from station to station, while the multiple images due to "ringing" will stay the same on all stations.

Scope Not Always Needed

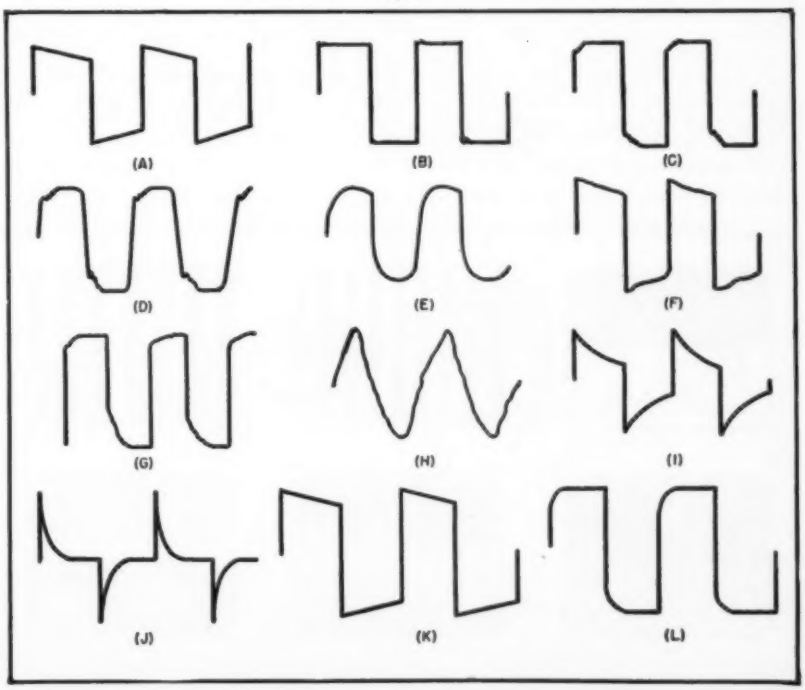
Although we have thus far been concerned primarily with the changes in signal waveform as observed on a cathode-ray oscilloscope, it is often possible to use square-wave signals for testing TV receivers even if an oscilloscope is not available. To do this, two conditions must be met. (1) The cathode-ray tube circuit of the TV receiver must be in operating condition, permitting the video signal represented by the square-wave to appear on the screen of the set; (2) It must be possible to either adjust the frequency of the "hold" controls in the receiver, or the frequency of the square-wave generator, until the square-wave signal "locks-in" with either the horizontal or vertical sweep circuits.

Assuming that the two conditions outlined above can be met, and this will be true in most cases, then a more rapid servicing technique may be employed. The connections of the square-wave generator remain as in Fig. 4, but no scope is necessary.

A square-wave signal with a frequency between 50 and 70 c.p.s. may be locked-in by adjusting the "Vertical Hold" control, and should appear as shown in Fig. 9A. Each "half" of the screen should be perfectly "white" or "black," with no shades of gray present, as long as the low frequency response of the receiver is normal (it may be necessary to adjust the "Contrast" and "Brightness" controls). A high-frequency square-wave signal (between 150 kc. and 450 kc.), when locked-in by adjustment of the "Horizontal Hold" control, should appear as a series of vertical black and white lines or bars, as shown in Fig. 9B.

Either the upper or lower "half" of the screen may be "white" when a low frequency square-wave signal is used,

Fig. 6



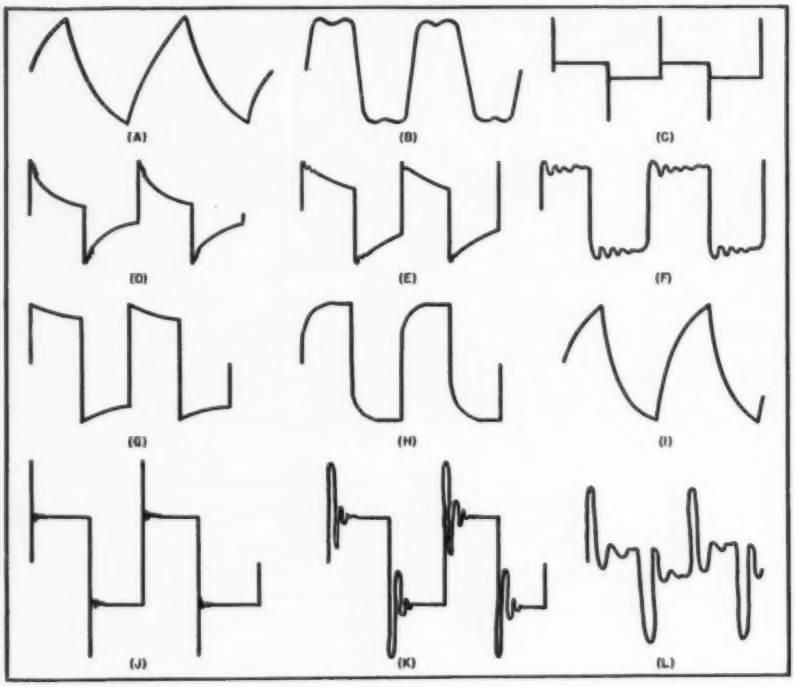


Fig. 7

Fig. 8

depending on exactly how the vertical sweep locks-in with the square-wave signal.

High Frequency Response may be determined by examining the vertical bars obtained with a high frequency square-wave signal (Fig. 9B). These bars should be distinct, with sharp black and white edges, and with each bar perfectly white or black.

Poor high frequency response causes a "haziness" along the edges so that the transition from "white" to "black" is not distinct or clear. This may be caused by too large a plate load resistor in the video amplifier, or by an open or shorted peaking coil, as we have seen (Figs. 6F-G-H-L and 7A-G-H-I).

Phase shift at high frequencies prevents the bars from being perfectly white or black over their entire width, and there may be a fading into gray.

Ringing, or damped oscillation, caused by too small a plate load resistor and similar defects (Figs. 7C-D-E-F-J-K-L), results in a series of fine lines following each change from white to black (and vice versa), as shown in Fig. 9C.

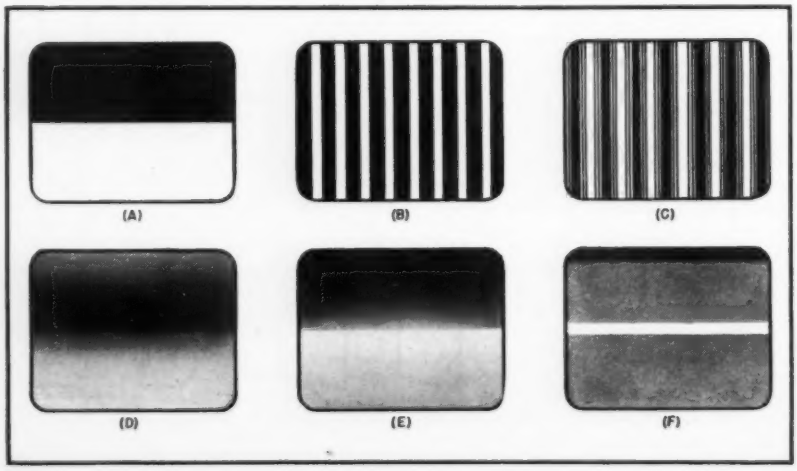
Low Frequency Response may be similarly checked by observing the pattern on the screen of the TV receiver. With normal response, a 50 to 70 c.p.s. square wave appears as a "black" and "white" half, as we have seen in Fig. 9A.

A boost in low frequencies due to over-compensation (Fig. 6E) results in a pattern as shown in Fig. 9D. Instead of sharp and distinct whites and blacks, the pattern appears as gray darkening to black, followed by gray lightening to white.

A loss in low frequencies (Fig. 6I) results in a pattern of black fading to gray, followed by white fading to gray as seen in Fig. 9E.

A severe loss of low frequencies, as may be caused by an open coupling condenser (Fig. 6J-K) appears as a black bar followed by a large gray area, with a white bar followed by a similar large gray area (Fig. 9F).

Fig. 9



Further Applications

If a signal generator supplying signals at either the TV i.f. or r.f. values is available, and it permits external modulation, then the square-wave generator may be used to check over-all response characteristics using the technique just described. The connections shown in Fig. 8 are used.

Be sure that the r.f. signal generator used will permit high-frequency square-wave modulation, however. If the generator will not permit this type of modulation, misleading results may be obtained.

Since a square-wave signal with a frequency between 150 kc. and 450 kc. will produce a number of equally spaced vertical bars or lines on the screen of the picture tube (once locked-in with the horizontal sweep), such a signal may be used for checking the horizontal linearity of the TV receiver, and for adjusting such controls as "Horizontal Drive," "Horizontal Linearity," and "Width."

A square-wave signal with a frequency between 600 and 900 c.p.s. may be locked-in by using the "Vertical Hold" control to produce a number of equally spaced horizontal lines or bars. Such a signal may then be used for checking vertical sweep linearity, and for adjusting the "Vertical Linearity" and "Height" controls.

As we have seen, the square-wave generator, when used alone, or in combination with an oscilloscope or r.f. signal generator, may be used for *quickly* checking such TV receiver characteristics as *definition, high-frequency response, ringing, low-frequency response and phase-shift, horizontal linearity and vertical linearity.* With these many possible applications, the square-wave generator ranks alongside the cathode-ray oscilloscope in versatility of application.

With a definite need growing for new and more rapid TV receiver servicing techniques, and with TV stations devoting less time to test pattern transmission (requiring other means for checking *definition* and *sweep linearity*), it may be that the square-wave generator will one day become as important a part of the TV servicing laboratory as is the vacuum tube voltmeter today. —30—

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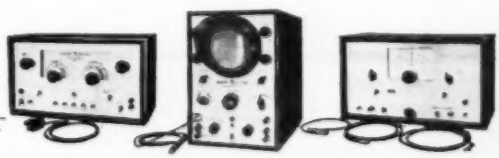

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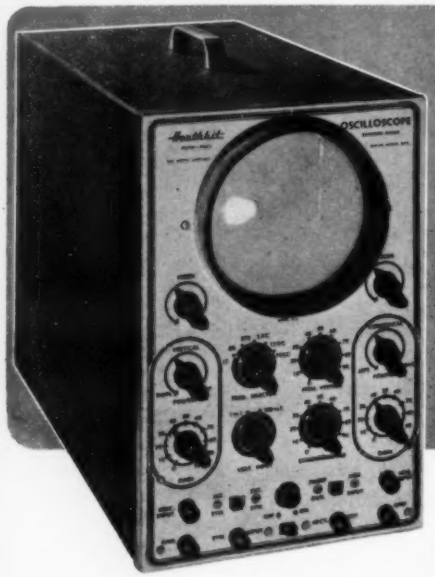

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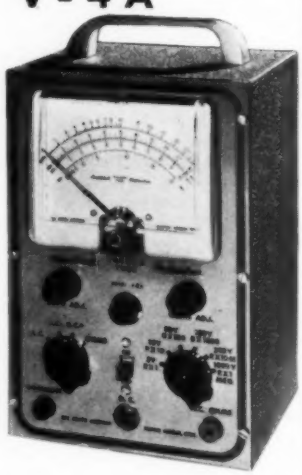

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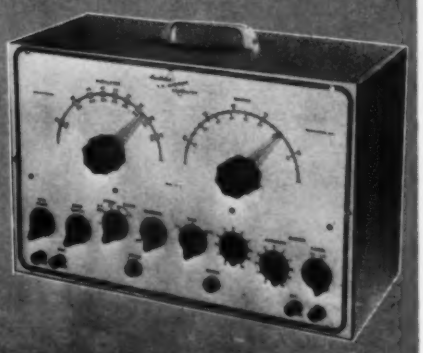

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Comes with power transformer, filament transformer, meter, 5Y3 rectifier, two 1619 control tubes, completely punched and formed chassis, panel, cabinet, detailed construction manual, and all other parts to make the kit complete.

LIMITS:

No load	Variable 150-400V DC
25 Ma	Variable 30-310V DC
50 Ma	Variable 25-250V DC
Higher loads	Voltage drops off proportionally

Model PS-1
Ship. Wt. 20 lbs.

$29.50

Heathkit

BATTERY ELIMINATOR KIT

Model BE-2
Ship. Wt. 19 lbs.

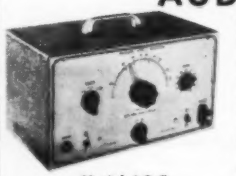
$22.50

A few auto radio repair jobs will pay for the Heathkit Battery Eliminator Kit. It's fast for service. The voltage can be lowered to find sticky vibrators or raised to ferret out intermittents. Provides variable DC voltage 5 to 7½ Volts at 10 Amps. continuous or 15 Amps. intermittent.

Also serves as storage battery charger. A well filtered, rugged power supply uses heavy duty selenium rectifier, a husky choke, and a 4000 MFD electrolytic condenser for clean DC. 0-15V voltmeter indicates output which is variable in eight steps. Better be equipped for all types of service — it means more income.

NEW *Heathkit* SINE and SQUARE WAVE

AUDIO GENERATOR KIT



Model AG-7
Ship. Wt. 15 lbs.

$34.50

We proudly present the NEW MODEL Sine and Square Wave Audio Generator Kit. Designed with versatility, usefulness, and dependability in mind, the AG-7 gives you the two most needed waveshapes right at your fingertips — the sine wave and the square wave.

The range switch and plainly calibrated frequency scale give rapid and easy frequency selection, and the output control permits setting the output to any desired level.

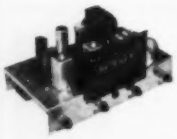
A high-low impedance switch sets the instrument for either high or low impedance output — on high to connect to high impedance load, and on low to work into a low impedance transformer with negligible DC resistance.

Coverage is from 20 to 20,000 cycles, and distortion is at a minimum — you can readily trust the output waveshape.

6 tubes, quality 4 gang tuning condenser, power transformer, metal cased filter condenser, ½% precision resistors in the frequency determining circuit, and all other parts come with the kit — plus, a complete construction manual. A tremendous kit, and the price is truly low.

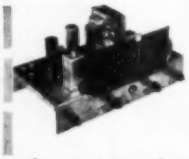
TWO HIGH QUALITY *Heathkit* SUPERHETERODYNE

RECEIVER KITS



Model BR-1 Broadcast Model Kit covers 550 to 1600 Kc. Shipping Wt. 10 lbs.

$19.50



Model AR-1 3 Band Receiver Kit covers 550 Kc. to over 20 Mc. continuous. Extremely high sensitivity. Shipping Wt. 10 lbs.

$23.50

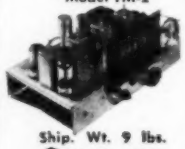
Two new Heathkits. Ideal for schools, replacement of worn out receivers, amateurs and custom installations.

Both are transformer operated quality units. The best of materials used throughout — six inch calibrated slide rule dial — quality power output transformers — dual iron core shielded I.F. coils — metal cased filter condenser. The chassis has phono input jack, 110 Volt output for phono motor, and there is a phono-radio switch on panel. A large metal panel simplifying installation in used console cabinets is included. Comes complete with tubes and instruction manual incorporating pictorials and step-by-step instructions (less speaker and cabinet). The three band model has simple coil turret which is assembled separately for ease of construction.

Heathkit

FM TUNER KIT

Model FM-2



Ship. Wt. 9 lbs.

$22.50

The Heathkit FM Tuner Model FM-2 was designed for best tonal reproduction. The circuit incorporates the most desirable FM features — true FM.

Utilizes 8 tubes: 7E5 Oscillator, 6SH7 mixer, two 6SH7 IF amplifiers, 6SH7 limiter, two 7C4 diodes as discriminator, and 6X5 rectifier.

The instrument is transformer operated making it safe for connection to any type receiver or amplifier. Has ready wound and adjusted RF coils, and 2 stages of 10.7 Mc IF (including limiter). A calibrated six inch slide rule dial has vernier drive for easy tuning. All parts and complete construction manual furnished.

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. . . BENTON HARBOR 15, MICHIGAN

Heathkit
ECONOMY . . . 6 WATT
AMPLIFIER KIT

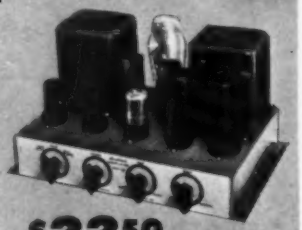
$12.50

Model A-4. Ship. Wt. 8 lbs.

This new Heathkit Amplifier was designed to give quality reproduction and yet remain low in price. Has two preamp stages, phase inverter stage, and push-pull beam power output. Comes complete with six tubes, quality output transformer (to 3-4 ohm voice coil), husky cased power transformer and all other parts. Has tone and volume controls. Instruction manual has pictorial for easy assembly. Six watts output with response flat ± 1½ db from 50 to 15,000 cycles. A quality amplifier kit at a new low price. Better build one.

No. 304. 12 inch Speaker $6.95

Heathkit HIGH FIDELITY . . . 20 WATT
AMPLIFIER KIT



$33.50

Our latest and finest amplifier — the Model A-6 (or A-6A) is capable of a full 20 Watts of high fidelity output — good faithful reproduction made possible through careful circuit design and the use of only highest quality components. Frequency response within ± 1 db from 20-20,000 cycles. Distortion at 3 db below maximum power output (at 1000 cycles) is only .8%.

The power transformer is rugged and conservatively rated and will deliver full plate and filament supply with ease. The output transformer was selected because of its exceptionally good frequency response and wide range of output impedances (4-8-16-150-600 ohms). Both are Chicago Transformers in drawn steel case for shielding and maximum protection to windings.

The unit has dual tone controls to set the output for the tonal quality desired — treble control attenuates up to 15 db at 10,000 cycles — bass control gives bass boost up to 10 db at 50 cycles.

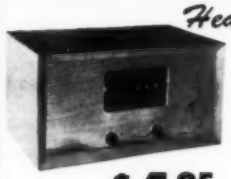
Tube complement consists of 5U4G rectifier, 6SJ7 voltage amplifier, 6SN7 amplifier and phase splitter, and two 6L6's in push-pull output. Comes complete with all parts and detailed construction manual. (Speaker not included)

MODEL A-6: For tuner and crystal phono inputs. Has two position selector switch for convenient switching to type of input desired. **Shipping Wt. 18 lbs. $33.50**

MODEL A-6A: Features an added 6SJ7 stage (preamplifier) for operating from variable reluctance cartridge phono pickup, mike input, and either tuner or standard crystal phono pickup. A three position selector switch provides flexible switching.

Shipping Wt. 18 lbs. $35.50

Heathkit RECEIVER AND TUNER CABINETS



$4.95

Blonde birch veneer cabinet for either of the receivers or tuner. The modern styling is an asset to any room. 5" speaker fits in end of cabinet when used with receivers. (Speaker not included.) Size 7 x 13½ x 18¼ inches. Order No. 345 for either receiver model. Specify No. 350 for the FM Tuner

Shipping Wt. ..... 5 lbs.

Metal professional type communications receiver cabinet. Finished in deep grey and fits the panel supplied with Heathkit BR-1 and AR-1 Receivers. 5" speaker mounts in end of cabinet. (Speaker and panel shown not included with cabinet.) Gives professional appearance to Heathkit receivers. Size 7 x 14 x 7¾ inches.

Specify No. 335 Shipping Wt. 6 lbs.

$4.50

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BENTON HARBOR 15,
MICHIGAN

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- ☐ Freight
- ☐ Best Way

Quantity	Item	Price	Quantity	Item	Price
	Heathkit Oscilloscope Kit — Model O-6			Heathkit R.F. Probe Kit — No. 309	
	Heathkit VTVM Kit — Model V-4A			Heathkit H.V. Probe Kit — No. 336	
	Heathkit FM Tuner Kit — FM-2			Heathkit R.F. Signal Gen. Kit — Model SG-6	
	Heathkit Broadcast Receiver Kit — Model BR-1			Heathkit Condenser Checker Kit — Model C-2	
	Heathkit Three Band Receiver Kit - Model AR-1			Heathkit Handitester Kit — Model M-1	
	Heathkit Amplifier Kit — Model A-4			Heathkit Power Supply Kit — Model PS-1	
	Heathkit Amplifier Kit — Model A-6 (or A-6A)			Heathkit Resistance Decade Kit — Model RD-1	
	Heathkit Tube Checker Kit — Model TC-1			Heathkit Impedance Bridge Kit — Model IB-1B	
	Heathkit Audio Generator Kit — Model AG-7				
	Heathkit Battery Eliminator Kit — Model BE-2				
	Heathkit Electronic Switch Kit — Model S-2				
	Heathkit T.V. Alignment Gen. Kit — TS-2				
	Heathkit Signal Tracer Kit — Model T-2				

On Parcel Post Orders, include postage for weight shown and insurance. (We insure all shipments.)

On Express Orders, do not include transportation charges — they will be collected by the Express Agency at time of delivery.

Enclosed find ☐ Check ☐ Money Order for_____

Please ship C.O.D. ☐ Postage enclosed for_____lbs.

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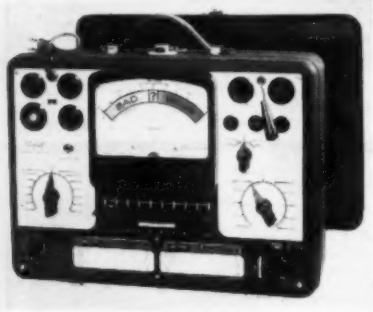
What's New in Radio

For additional information on any of the items described herein, readers are asked to write direct to the manufacturer. By mentioning RADIO & TELEVISION NEWS, the page, and the issue number, delay will be avoided.

TRIPLETT TUBE TESTER

The Triplett Electrical Instrument Co., Bluffton, Ohio is now in production on a new and improved tube tester, the Model 3413-A.

Designed to permit the checking of



any type radio receiving tube, miniature hearing aid tubes, pilot lamps, flashlight bulbs, and TV picture tubes, the tester gives both "short" and "open" circuit check of each element of every tube. TV picture tubes can be checked without removing them from the receiver by use of an adapter that may be purchased separately. A continuity test is provided for checking electrical appliances, motors, etc.

The Model 3413-A has flexible 3-position lever switches for complete coverage of present and future tube connections. RTMA pin numbering of the tube element levers makes for quick reference of tube base connections. An illuminated, easy-to-read roll type tube chart is built into the tester.

The instrument is housed in a portable metal case measuring $15\frac{11}{32}$" x $11\frac{1}{32}$" x $6\frac{1}{8}$".

SEALED TIMING RELAY

G-V Controls Inc., 28 Hollywood Plaza, East Orange, New Jersey has developed a hermetically sealed thermal time delay relay which has been designed to permit the adjustment of the time interval by the user while the relay remains completely sealed, thus retaining all the advantages of the present non-adjustable sealed thermal timing relays.

Adjustment is made simply by turning a screw located outside the sealed space. This screw permits the timing to be changed over a 5 to 1 range.

This adjustable relay is made in a new miniature size approximately ⅓ the size of the smallest previously marketed sealed thermal relay. The mini-

ature size, ¾" in diameter and $2\frac{3}{8}$" seated height, fits a 7-pin miniature tube socket. The unit is also available in the conventional size with octal base. Contacts are single pole, rated at 6 amperes and can be supplied either to close or to open at the end of the timing interval. Relays are available for any energizing voltage up to 125 v. and operate interchangeably on a.c. and d.c. Operating power is 4 watts and relays may be energized continuously without injury.

"UNIVERTER"

Boonton Radio Corporation of Boonton, New Jersey has announced the

Music's immortals play again, sing again, in RCA Victor's "Treasury of Immortal Performances"

A treasury of **Music's Immortals**

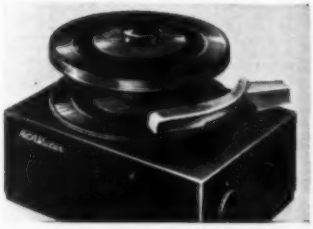
Now artists whose names are musical legend live again for the modern listener. You can hear them, at their finest, in RCA Victor's "Treasury of Immortal Performances."

In recreating these performances on both 33 and 45 rpm, acoustical engineers drew on a vault of master records guarded for posterity by RCA Victor. But new electronic techniques, developed through RCA research, give the new records a quality far surpassing that of the originals.

Because RCA Victor could draw on so vast a storehouse of the past, there is something in the "Treasury of Immortal Performances" for listeners of every age and taste. Caruso sings light and serious music—as do Schumann-Heink, Mary Garden, and others . . . Paderewski is here . . . and, if your taste is for popular music, such greats as Berigan, Armstrong, Waller, in rare early records.

* * *

See the latest wonders of radio, television, and electronics at RCA Exhibition Hall, 36 West 49th St., N. Y. Admission is free. Radio Corporation of America, RCA Building, Radio City, N. Y. 20, N. Y.



The magic of RCA Victor's "45" system—as an independent unit, or combined with radio or television receivers—has already led 55 record-makers to adopt it.

RADIO CORPORATION of AMERICA

World Leader in Radio — First in Television

availability of a new accessory unit for its BRC Type 202-B FM signal generator.

The Type 207-A "Univerter" is designed for use with the company's signal generator to provide frequency coverage from .1 mc. to 55 mc. Since the Type 202-B FM signal generator covers a frequency range from 54 to

216 mc., this combination of instruments permits continuous coverage from .1 mc. to 216 mc.

The "Univerter" is equipped with a frequency increment dial which is calibrated in increments of 5 kc. from plus 300 kc. through zero to minus 300 kc. This permits making selectivity measurements on narrow-band receivers.

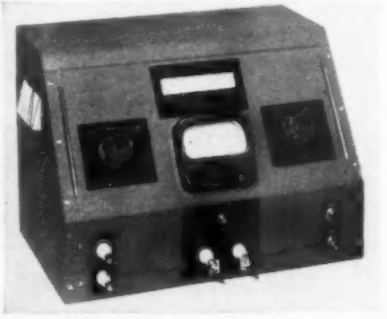
The r.f. output voltage across a 53 ohm load connected at the unity gain jack is continuously variable from .1 microvolt to .1 volt by means of the 202-B signal generator attenuator. The gain is constant within ±1 db. over the entire frequency range of the instrument.

Complete details on this new accessory are available from the company on request.

RESISTANCE COMPARATOR

Of interest to manufacturers is the new high speed automatic resistance comparator being marketed by *Clippard Instrument Laboratory, Inc.* of Bank Street, Cincinnati, Ohio.

The Model PR-5 will enable unskilled labor to test as many as 17 re-

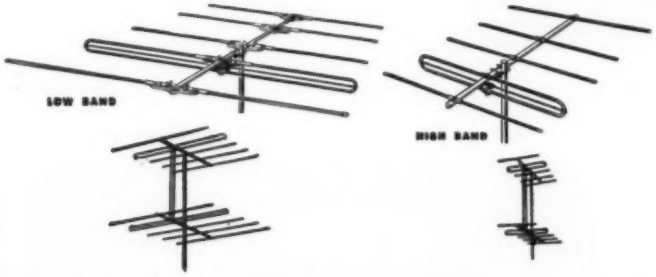


sistors per minute, irrespective of type. The new unit has been specifically designed for checking incoming shipments of resistors, matching, grading to close tolerances, or checking factory output.

new cure for old ailments

YAGIS *by* CHANNEL MASTER

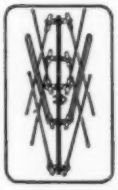
NEW "500" SERIES



STRETCH YOUR TV MARKET BEYOND PRESENT LIMITS

Now — say goodbye to reception problems common to fringe and sub-fringe areas. Get "up close" to those distant TV transmitters—*stretch* your market—open up new TV areas with Channel Master's new line of 5 element Yagis.

Precision cut for every channel, the "500" series combines high gain with high directivity at amazing low cost.



Ch.	No.	List Price
2 3	502 503	$17.65
4-6	504- 506	16.67
7-13	507- 513	7.65

Completely pre-assembled for instant set-up.

- Aluminum elements and crossarm.
- High impedance step-up dipoles of seamless tubing.
- ***Actual*** gain of single bay, 8 DB (***not*** theoretical).
- Front to back ratio, 26 DB.
- Matches 72 or 300 ohm line.
- Reflectors and directors of ⅜" butted tubing, ½" external sleeve.
- 1" crossarm on channel 2 and 3, ¾" crossarm on all other channels.

Sold only through Channel Master distributors.

FIRST IN PREASSEMBLED ANTENNAS

CHANNEL MASTER CORP.

NAPANOCH ROAD, ELLENVILLE, N. Y.

The instrument, which measures 18" wide, 12" high, and 12" deep, is completely self-contained and requires no outside attachments other than the standard resistor against which the unknown resistors are to be checked.

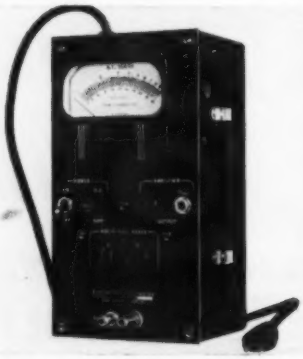
The meter is a square d.c. d'Arsonval unit inclined for easiest reading with minimum parallax. The meter scale reads in per-cent and is calibrated in three full scale ranges: −5 to +5%, −25 to +30%, and −50 to +100% deviation from standard. Accuracy is better than ±1% throughout the entire range of from 100 ohms to 100 megohms.

ELECTRONIC VOLTMETER

The Daven Company of 191 Central Avenue, Newark 4, New Jersey has recently developed a new electronic voltmeter, the Type 170.

The new unit covers a frequency range from 10 cycles to 250 kc. with an accuracy of ±2%. Its high stability circuit, with internal regulated power supply, makes its readings independent of normal power line variations.

It has an input impedance of 500,000 ohms while the cathode follower input

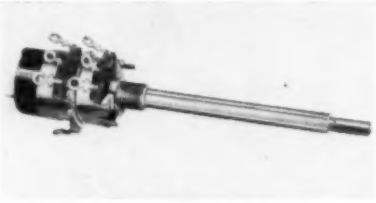


provides an effective input capacity as low as 6 μμfd. The multiplier control on the voltmeter provides four additional ranges of 20 db. in addition to the decibel range meter scale 0-20 db.

All readings are taken on a single, large, illuminated meter scale. The unit may also be used as a wide-range, high-gain amplifier because it is equipped with an output jack and separate volume control.

VARIABLE RESISTOR

The Wholesale Division of *P. R. Mallory & Co., Inc.*, P.O. Box 1558,



Indianapolis, Indiana has added a new dual concentric 15/16" variable resistor to its line of "Midgetrols."

In order to attain maximum coverage of a great variety of television and auto radio receivers, the dual controls are being sold in subassembly form. The technician can complete the assembly in less than five minutes, combining control sections of specified ratings for his particular application. The control sections are supplied in factory-assembled form, making possible complete factory inspection and testing. A new a.c. switch makes attachment simple and sure by positive indexing and design that permits secure locking in position without removing the control housing.

Additional details are available from the company.

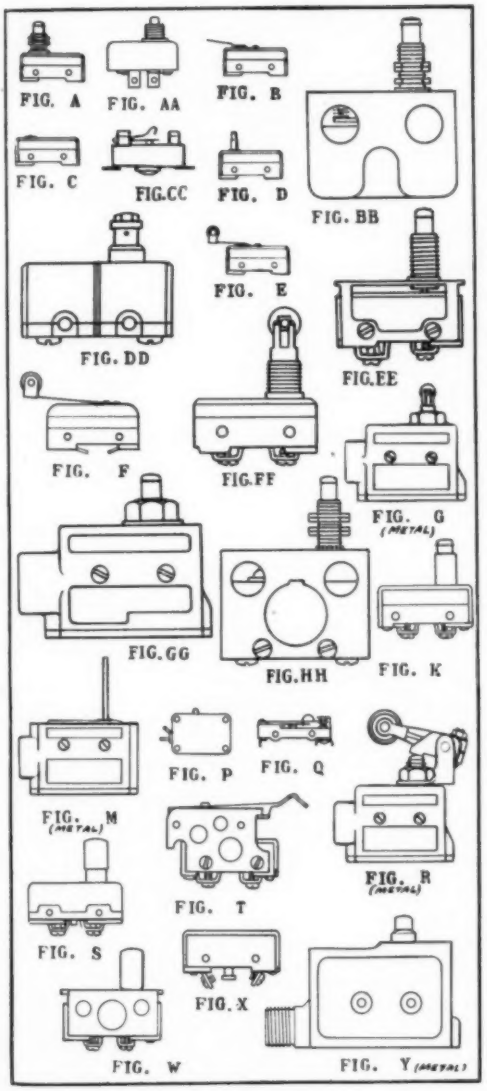
CIVIL DEFENSE RADIO

The *General Electric Company*, Syracuse, New York has developed a special FM radio receiver for use by civil defense organizations having two-way radio systems at their command. The

(*Continued on page* 124)

IMMEDIATE DELIVERY OF

Top Quality MINIATURE SWITCHES



This list of brand new standard brand miniature switches represents only a few of many types in stock at Wells. Large quantities of most types are on hand for your immediate requirements. Write or wire for quotations on switches not listed.

Stock #	Type #	Contact	Fig.	Price
41MC2	2M03.1A	NO	P	.50
41MM2	ACZ101BB	SPDT	W	.85
41MC6	APB236	SPDT	A	1.15
41MC26	APG210	NO	A	.80
41MC17	B-1	NC	Y	1.45
41MC16	B-1T	NC	DD	.90
41MC7	B-14	NO	HH	1.70
41MD62	B-R	SPDT	C	.70
41MD46	B-RL18	SPDT	B	.95
41MD63	B-RS36	SPDT	D	.80
41MD23	BD-RL32	SPDT	B	.95
41MLH	BZRQ41	SPDT	W	.85
41MD51	BZ-R37	SPDT	C	.70
41MD2	BZE7RQT2	SPDT	GG	1.70
41MD21	BZ-7RST	SPDT	D	.80
41MD38	BZE2RQ9TN1	SPDT	G	2.65
41MD6	CUM 24155	NO	E	.80
41ML1	D	NO	BB	1.50
41MC12	D in case	NC	Y	1.45
41MD34	ES692070	NC	CC	.50
41MD65	G-R26	NO	C	.60
41MD60	G-RL	NO	B	.80
41MC11	G-RL 5	NO	B	.80
41MD61	G-RL35	NO	B	.80
41MD41	G-RL43	NO	B	.80
41MD64	G-RS	NO	D	.55
41MD66	G-RS36	NO	D	.60
41MC32	HRD 7.1P2TSP1	NO	K	.65
41MC19	HRD 7.4P2T	NO	S	.60
41MD8	HRRC 7.1A	NC	C	.55
41MD27	HRRO 7.1A	NO	C	.60
41MC31	LN-11 H03	SPDT	M	1.70
41MC18	MLB 321	SPDT	B	.95
41MD1	MLR 643	NC	B	.70
41MD55	PS 2000	SPDT	C	.85
41MC28	RC71P2T	NC	A	.70
41MD45	RO1P2T	NO	A	.80
41MD22	RO2M	NO	E	.80
41MD28	RO2M12T	NO	E	.80
41MC25	R-RS	NC	D	.50
41MD47	R-RS13	NC	D	.50
41MD9	SW-186	NC	D	.50
41MC10	WP3M5	NC	AA	.50
41MC4	WP5M3	NC	AA	.50
41MD53	WP5M5	NC	AA	.50
41MC27	WZ2RST	NC	D	.55
41MD48	WZ2RT	NC	C	.65
41MD33	WZ3PW2	NC	F	.80
41MD16	WZ7R	NC	C	.55
41MD43	WZ7RQ1T	NC	A	.70
41MC15	WZ7RQT2	NC	A	.70
41MD36	WZ7RST	NC	D	.55
41MC24	WZE7RQTN	NC	Y	1.45
41MC23	WZE7RQTN	NC	R	3.75
41MD54	WZR8X	NC	X	.80
41MC9	WZR31	NC	C	.65
41MD57	WZR31	NC	T	.70
41MD31	WZRD	NC	C	.55
41MD19	WZRL8	NC	B	.70
41ML3	WZRQ41	NC	W	.65
41ML2	WZV7RQ9T1	NC	G	2.25
41MC21	X757	NC	C	.55
41MD37	XC1A	NC	C	.55
41MC5	XD45L	SPDT	B	.95
41MD4	YZ	NO	C	.75
41MD40	YA2RLE4D13	NO	B	.70
41MD24	YZ2YLTC1	SPDT	B	.95
41MC1	YZ2YST	SPDT	D	.60
41MD13	YZ3R3	NO	C	.60
41MD56	YZ3RLTC2	NO	B	.80
41MC14	YZ3RW2T	NO	F	.90
41MD49	YZ7RQ9T6	NO	FF	.85
41MD32	YZ7RST	NO	D	.60
41MC13	YZ7RA6	NO	EE	1.00
41MD25	YZRQ1	NO	A	.80
41MC20	YZRQ4	NO	S	.60
41MD59	YZRQ41	NO	W	.75
41MD20	YZ7RQT	NO	K	.65
41MD42	YZRTX1	NO	X	.95
41MC22	Z	NC	Y	1.45
41MD44	Blue Stripe	SPDT	C	.70
41MD52	Blue Dot	SPDT	E	.90
41MC8	Red Dot	NC	C	.65
41MD18	Open Type	SPDT	Q	.50
41MD39	Green Dot	NO	B	.80
41MC29	Green Dot	NO	D	.55
41MD26	Precision	SPDT	B	.95

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WIDE SELECTION OF ELECTRONIC COMPONENTS AT

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- Tubes • Resistors • Condensers • Wire and Cable
- Volume Controls • Co-ax Connectors • Relays • Rectifiers
- Transformers • Chokes • Micro Switches, Toggles • Antennas
- Accessories • Electronic Assemblies • Dial Light Assemblies

WELLS SALES, INC.

833 W. CHICAGO AVE., DEPT. R-5, CHICAGO 22, ILL.

McGEE'S "SUPER STORE" OPERATION SAVES YOU MONEY!

5 OZ4 TUBE & 5 VIB. DEAL No. RN-V5 ..... $9.50

Here's a red hot deal for you fellows that do a lot of auto radio service. 5 standard brand metal OZ4 tubes and 5 of our famous 4-prong serrated can vibrators. This vibrator is of the latest design, for long life. Standard diameter can, short enough to fit all Chrysler auto sets, also fits Motorola, etc. Our 20th Anniversary, big deal No. RN-V5. You can get 5 OZ4 metal tubes and 5 4-prong vibrators, all for **$9.50.** Shipping weight 3 lbs.

MN-8.	8 mfd 450 volt	39c
MN-16.	16 mfd 450 volt	49c
MN-30.	30 mfd 450 volt	59c
MN-20.	20 mfd 150 volt	49c
MN-40.	40 mfd 150 volt	49c
MN-220.	20-20 mfd 150v	49c
MN-53.	50-30 mfd 150v	59c
MN-442.	40-40-20 mfd 150v	69c

All cond. guaranteed one year.

RED HOT SPEAKER VALUES

McGee has a tremendous stock of 100,000 speakers to fill your needs. Every speaker is fully guaranteed. Order your speakers now.

4 inch,	square	1 oz. magnet	$1.69
5 inch,	pincushion	1 oz. magnet	1.79
6 inch,	pincushion	1.47 oz. magnet	2.79
4 x 6 inch		1 oz. magnet	2.29
5 x 7 inch,	oval	1.47 oz. magnet	2.49
7 inch,	pincushion	2.15 oz. magnet	3.49
8 inch,	pincushion	2.15 oz. magnet	3.49
6 x 9 inch,	oval	2.15 oz. magnet	3.49

100 Molded Plastic Bypasses $9.95

100 molded plastic tubular bypass condensers. All 600 volt. And all by the same nationally known mfgr. Regular dealers' net is over two and one-half times our 20th Anniversary sale price. You'll chuckle when you look these over. Here's what you get: 10—.001, 10—.002, 20—.005, 20—.01, 10—.02, 20—.03 and 10—.1 600 volt condensers. Our big deal No. RN-202. 100 plastic tubulars. Shipping weight 2 lbs. Net price, **$9.95.**

100 600 VOLT TUBULARS $6.95

100 top quality 600 volt tubular by-pass condensers. Made this year by a famous condenser factory. Don't confuse these with grab-bag surplus. McGee's deals are guaranteed to please you. Here's what you get: 10—.001, 10—.002, 20—.005, 20—.01, 10—.02, 20—.05 and 10—.1 600 volt condensers. Our big deal No. RN-203. Shipping weight 2 lbs. Net price, **$6.95.**

20 50 x 30 150 V. ELECTROLYTICS $10.95

Here's a red hot value. 20 of our XX quality replacement electrolytics. The most popular condensers in use today. Takes care of 90% of your AC-DC radio filter needs. Compact construction 1950 production. 1-year guarantee. 50-50 mfd. 150 volt, housed in a cardboard tube with common negative, has long flexible leads. 20th Anniversary, big deal No. RN-204. Sale price, **$10.95.**

SELENIUM RECTIFIERS

65 mil Selenium Rectifier, net ..... 39c each
100 mil Selenium Rectifier, net ..... 69c each
150 mil Selenium Rectifier, net ..... 79c each
200 mil Selenium Rectifier, net ..... $1.09 each
250 mil Selenium Rectifier, net ..... 1.19 each
350 mil Selenium Rectifier, net. 1.59 each
450 mil Selenium Rectifier, net. 1.79 each

McGee offers you the finest in Selenium rectifiers. All standard 130 volt.

1 or 4 VOLT CRYSTAL CARTRIDGES $1.99

McGee offers you a famous make crystal cartridge. Standard size and shape, but very light weight. Will track on ¾ oz. or more pressure. Stock A-6, one volt output, replaces Astatic L-70 etc., Net **$1.99.** Stock No. A-10, 4 volt output, replaces Astatic L-72 and L-82, etc., Net **$1.99.** Buy 10 assorted for **$19.00.**

5-Station Intercom Master $16.95

Model 2700 5-station intercom master, in an attractive walnut cabinet 10x5½x6". Push-button for each sub and talk-listen switch and volume control. AC-DC amplifier with lots of power and full size Alnico V PM speaker, 1950 production of a famous factory. Only 300 left, weight 7 lbs. Model 2700, net, **$16.95.**

10-Station Intercom Master $24.95

Heavy duty Model 2520 10-station intercom master in beautiful walnut cabinet, 14x6¼x7½" high. Powerful AC amplifier with 6V6 output, 6SJ7 and 80 rectifier. Heavy 2.15 oz. Alnico 5" PM speaker. Push-button for each of 10 stations, talk-listen switch and all call buttons; volume control. Installs as a 3-wire system. A fortunate purchase by McGee makes a saving for you. Model 2520, weight 12 lbs. Net, **$24.95** each.

25-WATT TRUMPET AND DRIVER $16.95

Full 12-month guarantee on this 25 Watt, all-weather re-entrant type, trumpet and driver combination. 15 Ohm impedance. 9" Bell diameter, 9¾" length. Made by a famous speaker manufacturer. New 1951 production, offered to you at a tremendous saving. Ideal for a deluxe paging speaker as well as general P.A. use. Complete with adjustable mounting bracket. Shipping weight 6 lbs. Model RE-17X, 25 Watt Trumpet and Driver. Net price **$16.95**

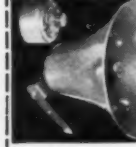
30-WATT TRUMPET and DRIVER $28.95

Model XX100-RM35. The finest trumpet driver combination value that we know. You get a full 30 Watt, 15 Ohm, PM Driver, guaranteed for 12 months and a 31½ ft. spun aluminum trumpet. (Bell diameter 18", air column 31½ ft., 16" overall length.) Both driver and trumpet have standard threads. (1¾-18). Driver is completely weather and waterproof. This is not surplus, but the latest 1951 production, by a famous speaker manufacturer. Trumpet furnished complete with adjustable mounting bracket.

RM-35, 30 Watt Driver unit only, shipping weight 6 lbs.
Net price **$15.95**

XX-100. 31½ ft. Trumpet only, shipping weight 15 lbs.
Net price **$13.95**

XX100-RM35, combination trumpet and driver complete. Net price.. **$28.95**

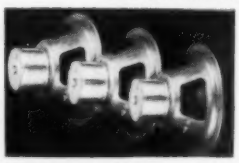


SUB-STATION FOR ABOVE INTERCOMS $3.95

Model MG-300 molded walnut plastic sub-station with call-back switch and heavy PM speaker, 5½x8½x3½", for wall or desk. Weight 2 lbs. Net, **$3.95** each; 5 for **$18.95.**

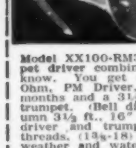
3 wire intercom cable, plastic, **$1.95** per 100 ft.; 500 ft., **$9.50.**

SUPER HEAVY DUTY 10" PM $6.95



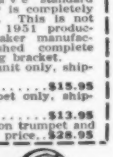
We made a special purchase on several hundred 20 watt, 10", 32 oz. Alnico 3 magnet PM speakers. Deep throat and easy moving cone. Ideal for all high fidelity sound systems and radio replacement. The magnet on this speaker is usually used on a 15" bass size. Very efficient, good high and bass response. You'll appreciate it when you get your hands on this speaker. Attractive copper finish. 8 ohm voice coil. Stock No. 1025PS. Weight 7 lbs. Net price **$6.95** each.

Order three of these and use them in a cluster of three. They will take 60 watts of audio and have more cone area than any 15" speaker. For high power, top quality P.A. work. Think this over. 3 No. 1025PS speakers for only **$19.95.**



12" 32 OZ. PM SPEAKER $7.95

12", 32 oz. magnet, 20 watt PM speaker, with 8 ohm voice coil. A regular $17.00 list Consolidated speaker. Weight 8 lbs. No. CN-1232, **$7.95** each. 4 for **$29.95.**



Special Sale Buy PM Speakers and Baffles for Less at McGee

Combination offer, buy a speaker and baffle at the same time and save money. Baffles are all plywood construction with Brown Leatherette covering and are the slanting, wall mounting type.

	Stock No.	
6 inch baffle and 6" PM	6-CR	$4.79
8 inch baffle and 8" PM	8-CR	5.49
10 inch baffle and 10" Heavy duty 32 oz. Alnico 3 PM	10-CR	8.95
12 inch baffle and 12" Heavy duty 32 oz. Alnico 3 PM	12-CR	9.95

5% discount on above speaker baffle combinations on orders of 3 or more.

PHONO MOTOR $3.95

9" Turntable heavy duty 78 RPM 110 Volt 60 Cycle, phono motor with heavy 1½ lb. turntable 4 pole motor. Don't confuse this with ordinary motor. Shipping weight 5½ lbs. Stock #GS-87, Net **$3.95,** 10 for **$10.00.**

BIG SALE ALUMINUM CAN ELECTROLYTICS

McGee offers you Nationally known brands of FP type electrolytic condensers at a tremendous saving. After these are gone, we don't know where we can buy any more to sell at these prices. Order a good supply now. Unconditionally guaranteed.

40-40 mfd.	25v.	FP cond. 1	x2"	$0.19	40-40 mfd.	150v,40-40 25v. FP cond. 1½	x2" $0.39
250 mfd.	25v.	FP cond. 1	x2"	.29	60-40 mfd.	150v, 10 25v. FP cond. 1	x2" .49
20-20 mfd.	150v.	FP cond. 1	x2"	.29	40 mfd. 300v, 50 25v, 20 200v.	FP cond. 1½	x3" .59
20-20 mfd.	150v, 25 25v.	FP cond. 1	x2"	.34	15 mfd.	400v,10-5350v FP cond. 1	x3" .49
20-20 mfd.	150v, 100 25v.	FP cond. 1	x2"	.44	8 mfd.	450v. FP cond. 1	x3" .29
40 mfd.	150v, 200 10v.	FP cond. 1	x2"	.29	10 mfd.	450v. FP cond. 1	x3" .34
30-30 mfd.	150v.	FP cond. 1	x2"	.39	16 mfd.	450v. FP cond. 1	x3" .34
40-20 mfd.	150v.	FP cond. 1	x2"	.39	20 mfd.	450v. FP cond. 1	x3" .39
80 mfd.	150v.	FP cond. 1	x2½"	.29	24 mfd.	450v. FP cond. 1	x3" .39
50-50 mfd.	150v, 25 25v.	FP cond. 1	x2½"	.49	30 mfd. 450v, 30 350v, 40 25v.	FP cond. 1	x3" .49
80-40 mfd.	150v.	FP cond. 1	x3"	.49	20-10 mfd.	450v. FP cond. 1½	x3" .69
80-40 mfd.	150v, 25 25v.	FP cond. 1	x3"	.59	20-20 mfd.	450v. FP cond. 1½	x3" .89
40-40-20 mfd.	150v.	FP cond. 1	x3"	.59	32 mfd.	450v. FP cond. 1	x3" .39
15-15 mfd.	150v,1200 1½ v.	FP cond. 1	x2"	.49	30-15-10 mfd.	450v, 20 25v. FP cond. 1	x3" .69
30 mfd.	250v.	FP cond. 1	x2"	.19	30-10-10 mfd.	450v, 20 25v. FP cond. 1	x3" .59
40 mfd.	250v.	FP cond. 1	x2"	.19	80 mfd.	450v. FP cond. 1½	x3" .59
15-15 mfd.	250v.	FP cond. 1	x2"	.29	20-20-20 mfd.	450v. FP cond. 1½	x3" 1.19
40-20 mfd.	150v, 100 15v.	FP cond. 1	x3"	.39	40-30-10 mfd.	450v, 20-25v. FP cond. 1½	x3" 1.49
30-50 mfd.	150v, 20 50v, 100 10v.	FP cond. 1½	x2"	.49	40-40-40 mfd.	450v. FP cond. 1½	x3" 1.49

UNIVERSAL OUTPUTS

Universal replacement output transformers in push-pull or single plate. 2500 to 13,000 ohms, from 2 to 16 ohm voice coil. Standard size strap mounting with long leads and lugs for voice coil connections. U-5, 5 watt universal.

Net	$ .99
U-8, 8 watt universal	1.19
U-15, 15 watt universal	1.39
U-20, 20 watt universal	1.79

5 watt, single universal output transformer. Any tube to 3.2 ohm voice coil. It pays to have some of these around the shop. They come in handy. No. JJ-4, ea. 79c; 10 for **$7.50;** 25 for **$17.50.**

McGee's Super High Fidelity Best Value in U.S.A. OUTPUT TRANS. 20-20,000 CPS. $7.95

Model A-403 High fidelity output transformer. Why pay $20 or $30 for an output, when our A-403 is available at $7.95? Impedance, 6600 ohms plate to plate, (for PP 6L6 or 6V6), 100% feedback winding, 4-8-15-250 and 500 ohm secondary. Housed in a potted case. Net weight 6 lbs. Recommended for all amplifiers up to 34 watts.

4-PRONG VIBRATORS $1.29 IN ALUMINUM SERRATED CANS

10 FOR $11.90

4 MILLION AUTO RADIOS BUILT IN 1950 AND HERE IS THE PERFECT REPLACEMENT VIBRATOR FOR MOST OF THEM.

Latest 1951 production by a top quality manufacturer. Fully guaranteed six months. Quiet running. A result of modern vibrator engineering and research. Replaces Motorola, Chrysler and any standard 4 Prong non-sync Vibrator. McGee contracts for a tremendous quantity to take care of your 1951 needs. Stock #V-53 Standard 4 Prong Vibrator **$1.29** each, 10 for **$11.90.** Offset 4 Prong for Delco, etc., **$1.39** each. 10 for **$12.90.**

Buick Replacement same as Delco 5050500. Fits all Buicks, 1937 thru '47, etc. **$1.95** each, 10 for **$17.90.**

Mallory 534C 7 Prong Reversible Sync.. **$1.95** each, 10 for **$17.90.** Offset 4 Prong for Delco, etc..**$1.39** each

19 TUBULAR ELECTROLYTICS DEAL RN-PL19 $7.50

19 tubular electrolytics, guaranteed for one year. All fresh stock in aluminum tubes with cardboard insulating sleeves. You must be satisfied or money back. You get, 10 8 mfd. 450 volt, 4 16 mfd. 450 volt, 3 20 mfd. 150 volt and 2 40 mfd. 150 volt condensers. Shipping weight 2 lbs. Deal #RN-PL19. Net **$7.50.**

10 FP ELECTROLYTICS DEAL RN-10DS $3.49

10 assorted F.P. aluminum can electrolytics. Popular twist tap mounting. Mostly multiple section banks. 150, 350 and 450 volts. A red hot deal. Shipping weight 2 lbs. Deal #RN-10DS, Net **$3.49.**

10 BOXES OF PILOT LIGHTS $5.49

Pilot lamps, boxed 10 to a handy carton, American made, 7 boxes #47, 1 box #40, 1 box #44 and 1 box #46. A total of 100 lamps. Deal #CM-51. Net **$5.49.** 100 #47 imported panel lamps. Guaranteed, 100 to the carton. Deal #RN-J47. Net **$4.49.**

50 8 MFD. 450 VOLT COND. MONTHLY SPECIAL $16.95

McGee's serviceman's monthly special for April. You get 50 of our regular 79c NN8 8 MFD 450 Volt Tubular Electrolytics for only **$16.95.** Full one-year guarantee. Aluminum Tubular construction with cardboard insulating sleeves. Fresh stock 1951 production. 2nd to none. Shipping weight 3 lbs. Deal No. NPL-58 50 8MFD 450 Volt Tubulars for **$16.95.**

V.M. 3 SPEED Record Changers $24.95

VM Model 406 deluxe 3 speed automatic record changer—plays them all—intermixes records of the same speed—equipped with a flip over crystal pickup with twin needles—a very sleek designed record changer—base size 12¼x14. Ship. weight 12 lbs. VM-406. Net **$24.95.** Buy the VM-950 changer with or without base. Choice of G.E. VR or crystal cartridge. We think the VM-950 record changer is the finest in America. It automatically plays all records all speeds and all sizes; 12 10-in., 33⅓ or 78 rpm, 10 12-in., 33⅓ or 78 rpm and 12 and 10-in. records of the same speed intermixed, 12 7-in. 33⅓ or 12 7-in. 45 rpm. Automatically shuts off after the last record. Size 13 13/16x11⅞x7¼ in. high. Offered with crystal cartridge, G.E. VR cartridge, or either with a base. VM-950, 3 speed changer with standard output crystal cartridge and needles for 1 and 3 mil. (78 rpm, 33⅓, 45 rpm.) Net **$29.62.**

VM-950GE, 3 speed changer with the new RPX-050 magic button, all-in-one variable reluctance cartridge with stylus. Net **$32.80.**

VM-955, 3 speed changer with crystal cartridge on a base. Net **$32.01.**

VM-955GE, 3 speed changer with RPX-050 VR cartridge and stylus; with base. Net **$33.19.**

2-STATION INTERCOM $16.95

Complete, top quality two station intercom system, $14.95. With 50 feet of connecting cable. New 1951 production, housed in matching walnut plastic cases. Master has push-to-talk switch. May be used on wall or desk. Conventional amplifier using 12SJ7, 50L6 and 35Z5 tubes. Stock No. MG-38, weight 8 lbs. Net price **$16.95.** Extra sub for use in parallel with other sub as a non-selective 3 station system, **$3.95.**

RED HOT ELECTROLYTIC SPECIALS

ORDER 100 ASSORTED FOR $37.50

Stock No. EC-4, Capacity 40-40-20, voltage 150v. Net each 40c
Stock No. EC-552, Capacity 50-50, 200; voltage 150-50v. Net each..... 40c
Stock No. EC-3132, Capacity 40-40, 200; voltage 150-15v. Net each 40c

Tubulars in cardboard tubes with long flexible leads. Fully guaranteed. 10,900 to sell at this bargain price.

McGEE RADIO COMPANY Prices F.O.B. K.C. Send 25% Deposit with Order, Balance Sent C.O.D. With Parcel Post Orders, Include Postage

TELEPHONE VICTOR 9045. WRITE FOR FLYER 1422 GRAND AVE., KANSAS CITY, MISSOURI

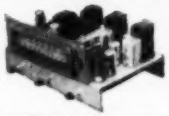
McGEE HAS COMPLETE KITS FOR SCHOOLS AND CUSTOM BUILDERS

7-TUBE FM-AM TUNER

★ AC SELF POWERED

★ 3 GANG TUNING ★ A COMPLETE KIT

$29.95



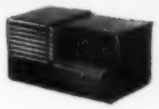
McGee has ready for delivery, this self powered AC, 7 tube FM and AM superhet tuner kit. Build yourself a professional looking tuner that may be connected to any audio amplifier. Receives broadcast 550 to 1650 kc and FM 88 to 108 mc. A 3 gang tuning condenser is used on both FM and AM. This extra stage of TRF makes a smoother working tuner. 2 IF stages on FM and one IF stage on AM (I.F. frequency 456 and 10.7 mc). Lighted slide rule dial with metal escutcheon plate. Our own lab designed and wired an original tuner using these parts. Chassis is ready punched and painted. Everything furnished including tubes and diagrams. Shipping weight 12 lbs. Stock No. RAL-8, net price **$29.95.**

MODEL ME6-2 $19.95

NEW MODEL 6-TUBE, 2-BAND RADIO KIT

A FULL 2-GANG SUPERHET KIT

RECEIVES 550-1600 KC PLUS 6-18 M.C.

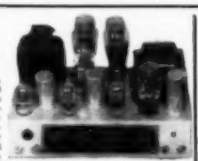


McGee's new 1951, 6 tube; AC-DC 2 band radio kit. Receives broadcast, 550 to 1600 kc and short wave, 6 to 18 mc. A straight forward superhet circuit with 2 gang tuning condenser, 456 kc I.F. transformers, etc. 5" PM speaker illuminated slide rule dial. Everything furnished, including tubes, diagram and a photo showing view of underside of completely wired chassis. The chassis pan and dial parts are factory production. With this kit, you can build a commercial looking and factory quality 2 band radio, housed in a streamlined plastic cabinet. Size: 13 x 6⅝ x 6¼". Stock No. ME6-2, shipping weight 10 lbs. Net **$19.95.**

SELF POWERED AC Broadcast Tuner Kit. 3-Gang Tuning. Complete Kit, $12.95

A self-powered, 3-gang superhet tuner kit with R.F. stage. When wired according to our diagram will make the best possible broadcast tuner (550 to 1650 kc), for use with any amplifier. Don't class this with ordinary tuners; this has its own power transformer. This complete kit is furnished with a diagram, photos and tubes: 6SH7 R.F., 2—7S5 converter-mixer-oscillator, 6ST7 I.F. detector, and 7Y4 rectifier. Connect to any audio amplifier. Ideal for use with our S-2020, TM-16 or 7X5 amplifier kits. Chassis size, 9½x4⅜ 4½" high. Shipping weight, 7 lbs. Broadcast tuner kit Model BT-38X. Net price, **$12.95.**

8-TUBE 22 WATT Wide Range Amp. Model 7x5 Kit Only $37.95



A complete kit, including tubes (3-7E5, 2-7F7, 2-6A3, plus rectifier), diagram and photos. All triode circuit makes for minimum harmonic distortion. Inputs for radio tuner any kind of phono pickup (crystal or G.E. variable reluctance) and either crystal or dynamic mike. Output transformer matches 8 ohm voice coil. Twin electronic tone controls, bass and treble with range selector switch for either juke box quality with heavy bass response or brilliant symphonic range. The best quality amplifier kit we know how to make. Has a very wide range output and heavy power transformer. Response 18 to 20,000 CPS. 8 tube all triode amplifier kit, complete with tubes. Weight 25 lbs. Net **$37.95.**

$19.95 BUYS THIS ALL PURPOSE 18 WATT AMP KIT

High fidelity amplifier kit. Model S-2020. Has inputs for radio tuner, any phono pickup, crystal or G.E. variable reluctance as well as crystal or dynamic mike. Controls can be mounted on the chassis or on extension leads, as pictured. Has broadcast quality shielded $10.00 value output transformer. Matches 8 ohm speaker. A complete amplifier kit with tubes: 3-7F7, 2-7C5, plus rectifier. A fine amplifier for the home music system. Model No. S-2020, weight 16 lbs. Net **$19.95.**

5-TUBE BROADCAST SUPERHET RADIO KIT $12.95

Model NS-5X 5 tube AC-DC superheterodyne radio kit. Has loop antenna and 2 gang condenser, with lighted slide rule dial and attractive plastic cabinet. Receives broadcast, 550 to 1650 kc. Full size dynamic speaker, matched 456 I.F.'s, automatic volume control. This is a complete radio kit. Everything furnished, including diagram, photos and tubes: 14B6, 14Q7, 14A7, 50B5 and rectifier. Shipping weight 7 lbs. Stock No. NS-5X. Net price **$12.95.**

Build Your Own Phono-Mike Oscillator Kit $7.95

Kit Model DE-6R. With this simple kit, you can build a 3-tube phono oscillator that also has a mike input. Will broadcast over any radio, within your home, (about 75 feet) from 800 to 1500 kc. Inputs for crystal mike or crystal phono pickup. Fader control fades from mike to record. Ideal for a home P.A. system, baby listener and home entertainment. A complete kit of parts including tubes. Kit Model DE-6R. Net price, **$7.95.** DE-6XWT, wired and tested. Net price, **$9.95.** Crystal mike and desk stand, **$4.95** extra. Concealed microphone unit, only 1" in diameter and ¼" thick. Specify hidden mike when ordering. Stock No. T-001. Net, **$3.95** extra.

3-SPEED RECORD PLAYER KIT $13.95

Complete record player kit to build a 3 speed player. Heavy 3 speed phono motor, universal crystal pickup, all parts and tubes to build a 7OL7 type amplifier in an attractive walnut case with grill for speaker cut on top. Kit model D-3378, net price **$13.95.**

NEW T.V. KIT $99.95 USE UP TO 14" KINE

Sensational New AC-DC Television Kit which is shipped with major parts mounted on T.V. Chassis. Ready wired and pre-aligned. Only 8 hours required to finish building this nice neat T.V. Chassis! For use with picture tubes up to 14" Rectangular. A complete Kit with all parts, tubes (except picture tube), and standard coil. 12 Channel, ready wired tuner. Bright cadmium. Chassis 17x14x4½". 4x6" Speaker. Shipped with 10, 12 or 14" Safety Mask (specify when ordering). Ship. wt. 30 lbs. Kit Model K-142T. Net **$99.95.** 14" 14BP4A Blackface Picture Tube, **$19.00** extra. 12½" Neutral Face Picture Tube, **$17.95 extra.**

BUY YOUR WIDE RANGE COAXIAL SPEAKER AT McGEE

12" COAXIAL PM $13.95

A $32.50 retail value. 20 watt 12" coaxial PM speaker of quality used on radios of the $300 to $500 bracket. Hook up like any PM speaker. High pass filter is built on speaker. Matches 8 ohm output of radio or amplifier. Wide range response, 20 to 17,500 CPS. Model No. CU-14X, weight 10 lbs. Special sale price, **$13.95,** or two for **$27.00.**

15" COAXIAL PM $19.95

Only $19.95 buys a full 15", 20 watt coaxial PM speaker with built-in high pass filter. Hook to any 8 ohm output on radio or amplifier. Response below 20 to above 17,500 CPS. Good bass response. A lucky purchase makes this price possible. Full 32 oz. magnet in the woofer. 5" tweeter. Model P15-9, Weight 14 lbs. Sale price, **$19.95,** or two for **$37.00.**

GUARANTEED T.V. PICTURE TUBES—PARTS

CONVERSION KIT FOR 16" $34.95 with Flyback and Conversion Data

Big deal of the month! A 16" rectangular, blackface picture tube, plus a heavy plastic combination mask and safety glass, with gold colored trim; plus a 70 degree deflection yoke all for **$34.95.** This kit enables you to make conversions worth $75.00 or more. Shipping weight 25 lbs. Shipped via express or freight only.

PICTURE TUBE SALE AND LOOK AT THE PRICES

We got 'em. Good quality picture tubes. Unconditionally guaranteed for 90 days. Save on these for your replacement and conversion needs.
NOTE: 10MP4 REPLACES 10BP4 without any circuit changes.

	Net each 3 lot price	Net each price
10MP4 10" perfect sub for 10BP4	$17.95	$17.00
12LP4 12" round glass, clear	17.95	17.00
14CP4 14" rectangular blackface	19.95	19.00
15DP4 15" round glass, clear	34.95	32.95
16JP4 16" round glass, clear	24.95	22.95
16GP4 16" round metal, blackface	$27.95	$25.95
16RP4 16" rectangular blackface	27.95	24.95
17CP4 17" rectangular blackface	27.95	24.95
19AP4A 19" round metal blackface	39.95	none
20CP4 20" rectangular blackface	39.95	none

6-TUBE AUTO SET $27.95

with separate 5" PM speaker or 7" PM, $2.00 Extra

A Red Hot close-out value. 6-tube superhet auto radio for universal underdash mounting. Size 13" deep, 6" wide and 4" high. Uses 2—6SK7, 6SA7, 6SQ7, 6V6 and 6X5 tubes. Stock No. AM-6, auto radio, complete with heavy duty 5" PM speaker, to mount in dash. Ideal for all cars and trucks. May be purchased with 6x9" or 7" PM speaker for extra $2.00. Shipping weight 16 lbs. Net price with 5" PM, **$27.95.**
66" 3 section side cowl antenna, shipping weight 2 lbs. Net, **$1.95.**
56" 3 section top cowl antenna, shipping weight 3 lbs. Net, **$3.27.**

T.V. BOOSTER REGENCY $19.10

Regency DB-410 television booster. A real engineered unit, small and compact. Slug tuned, using 1—6J6 tube as neutralized push-pull amplifier. Dollar for dollar, your best booster buy. 5¾x 4¾". For 110 volt AC operation. Weight 6 lbs. Net price **$19.10.**
Astatic AT-1, "Channel-Chief" booster. Two tuned circuits and two broad circuits on all channels. Dual controls tune sound and picture independently. 6½x2¾x1¼". Weight 6 lbs. Net price, **$32.70.**
Astatic BT-1 television booster. For either 72 or 300 ohm input and output. Woodgrain metal cabinet. Weight 4 lbs. Net **$19.10.**

BUY YOUR TELEVISION MATERIAL AT McGEE

20 MATCHED VIDEO COIL KIT $7.95

20 matched TV video and sound I.F. coils. Intended for use with the RCA circuit. You get 6 peaking coils, 4—25.75 mc picture I.F.'s, 2—21.25 mc sound I.F.'s, discriminator and converter coil and 3 filament chokes. Stock No. 205-XX, weight 3 lbs. Net price, **$7.95. $6.95** if purchased with a Sarkes-Tarzian TV tuner; all coils identified.

SARKES-TARZIAN TV TUNER $9.95

Sarkes-Tarzian 13-channel television front end tuner. Factory-wired. Rotary switch type of popular today on many TV sets. Also good for building purposes. 6C4 oscillator, 6BH6 RF and 6AG5 mixer. Output of tuner feeds your converter coil, I.F.'s etc. Stock No. T-3, weight 3 lbs., has converter coil built on. Our 205-XX video coil kit, **$6.95** extra, when ordered with tuner.

TUBES

Guaranteed quality tubes for radio sets and TV. Tubes have been difficult for us to keep in stock. If you need tubes and will accept them, either individually cartoned or unboxed, we will do our best to supply your needs.

Note: (B) Uncartoned, (C) Cartoned, (R) Raytheon, (KR) Ken-Rad, (S) Sylvania, (TS) Tung Sol, (NU) Nat'l. Union, (J) Jewel, etc.

0Z4	R	B	.83	6AQ5	J	B	1.00	7B4	S	B	.90
1A5	J	C	.90	6B8g		B	1.60	7B6	S	B	.90
1B3	KR	B	1.32	6BG6	R	C	2.40	7C4	S	B	1.10
1C6	KR	C	1.60	6C5	R	C	.83	7C5	S	B	.90
1L4	S	B	1.00	6C6	R	C	1.10	7E5	P	B	1.10
1LA4	R	C	1.32	6F5	R	C	.83	7F7		B	1.10
1LC5	S	B	1.32	6F6g	A	B	.90	7F7	S	B	1.10
1LC6	S	B	1.32	6F7	R	C	1.60	7N7	NU	C	1.00
1LD5	S	B	1.32	6K6gt	R	C	.83	7L7	KR	B	1.10
1LG5	S	B	1.32	6K8gt	R	C	.83	7N7	J	B	1.10
1LH4	S	B	1.32	12SA7		B	1.08	7V7	S	B	1.32
1LN5	R	C	1.32	12SK7		B	.80	7Y4	S	B	.90
1N5	KR	B	1.32	6K7	R	B	1.00	7Z4	S	B	.90
1Q5		B	1.32	6K8g	W	C	1.60	10Y		C	1.95
1S5	R	C	1.00	6L7g	R	C	1.60	12A8gt	R	C	1.10
1T4	R	C	1.00	6Q7gt	R	C	.90	12J5gt	R	C	.90
1T5	S	B	1.32	6S4	J	B	1.00	12J7	NU	B	1.10
1V2	R	C	.75					12K8	KR	B	1.32
1X2A	R	C	.75	6S07	TS	C	1.45	12Q7		B	.90
2A5	R	C	1.10	6SF5	TS	B	.83	12SF5	S	B	.90
2A7	R	C	1.32	6SF7	S	B	1.00	12SH7	KR	B	1.10
3A4	TS	C	1.00	6SQ7	R	C	1.00	12SL7	R	C	1.20
3LF4	R	C	1.32	6SH7	KR	B	1.10	12SN7		B	.90
3Q4	R	C	1.10	6SJ7	R	C	.90	50L6		B	.90
3S4	R	C	1.00	6SK7	R	C	.90	12SR7	KR	B	1.10
5T4	R	C	2.40	6ST7	R	B	1.00	12SG7	rush		
5U4G	R	B	.83	6ST7	KR	C	1.32		O.K.		.49
5W4	R	C	.83	6SV7	KR	C	1.45	14A4	R	C	1.32
5X4	R	B	.83	6V6	KR	B	1.00	14A7	J	B	1.10
5Y3gt	R	B	.63	6W4	KR	B	.90	14B8	S	B	1.10
				6X5g	S	B	.75	14C5	KR	C	1.32
5Y4	R	C	.75	6Y7g	R	C	1.60	14E6	R	C	1.10
5Z4	R	C	1.32	7A5	R	C	1.10	14E7	R	C	1.32
6AB4	R	C	1.10	7A6	R	C	.90	14H7	R	C	1.20
6AG7	R	C	1.60	7A7	R	C	.90	14N7	R	C	1.32
14R7	C	C	1.32								
14W7	KR	C	1.32								
14Y4	R	C	1.20								
14X7	KR	C	1.32								
19BG6	R	C	3.00								
24A	MH	C	1.00								
25W4gt	R	C	1.00								
25Z6gt	KR	B	.83								
26	KR	C	1.00								
27	J	B	1.10								
35/51	GE	C	1.10								
35Z5	R	B	.88								
35/44	R	C	1.32								
41	R	C	1.00								
42	KR	C	1.00								
43	R	C	1.00								
47		C	1.45								
80AS	S	C	1.10								
80Y6		B	.90								
50	MW	C	.90								
57	MW	C	1.00								
75	GE	C	1.00								
76	Z	C	.83								
77	R	C	1.00								
78	R	C	1.00								
85		C	1.10								
89	GE	C	1.10								
117L7	KR	B	1.95								
117N7	R	B	1.95								
117Z6	CR	B	1.20								
9003	JAN	C	1.00								
6BQ6		C	1.10								
6AU6		B	1.00								
6AQ5		B	1.32								
50C5		B	1.60								

BRAND NEW GENERAL INST. TELEVISION FRONT END-TUNERS

Sale Price **$7.95**

All completely wired, brand new and pre-aligned, 13 channel selector incorporating fixed inductance and variable capacitance. Converter output transformer is attached to be coupled direct to separate sound and video I.F.'s. 3 6J6 tubes are required. Shaft length 2¼". Built in fine frequency control. Original factory cost over **$20.00.** Weight 4 lbs. Stock No. GI-13P, less tubes. Net price **$7.95.**

GI-TUNER SCOOP $2.95

Same tuner as above, only they have been cut out of TV sets. A good value for the experimenter. GI-13PX, as is, less 3—6J6 tubes. Net price, **$2.95** each.

BRAND NEW R. C. A. TELEVISION FRONT END-TUNERS

Sale Price **$14.95**

A fortunate purchase from a T.V. set manufacturer makes this value possible. RCA 13 channel completely wired, tested and aligned T.V. tuner. A 13 channel selector switch with outer sleeve fine frequency control. Converter output transformer is attached for direct coupling to video and sound I.F. stages. Shaft length, 3⅜". Original dealer's cost on this item was over **$30.00.** McGee offers them to you brand new (they have never been soldered to or in sets) for only **$14.95,** less tubes, (3 6J6 tubes required). Shipping weight 2 lbs. Stock No. RCA-13P, less 3 6J6 tubes. Net **$14.95,** two for **$27.95.**

T.V. ANT $1.29

Built-in Television Antenna as used by a big TV set manufacturer. Does a better job than the so-called Rabbit Ear Antenna in many cases.

Made on a thin sheet of press-board, 15¾" long x 14" wide, less than ½" thick. Effectively 2 single dipoles.

52 degree deflection yokes, for 10, 12 and 16" round tubes, **$2.95** each. 70 degree deflection yokes for 14, 16, 17 and 19" rectangular tubes, **$3.49** each.

New small horizontal output (flyback) 14000 volt, **$3.99.** Philco 12 or 16" horizontal output (flyback), **$3.49.** Vertical output transformer, strap mounting, **$1.98.** Vertical oscillator transformer, strap mounting, **99c.** Single magnet ion trap, **49c.** Double magnet ion trap, **89c.**

McGEE RADIO COMPANY Prices F.O.B. K.C. Send 25% Deposit with Order. Balance Sent C.O.D. With Parcel Post Orders, Include Postage

TELEPHONE VICTOR 9045. WRITE FOR FLYER
1422 GRAND AVE., KANSAS CITY, MISSOURI

Speaker Cabinets

(*Continued from page* 56)

net wall has been completely eliminated. The sharpness of the edge has also been reduced which mitigates the diffraction effects due to this edge. The response frequency characteristic of a loudspeaker mechanism mounted as shown in Fig. 9B is shown in Fig. 10A(b). Comparing the response frequency characteristics of Figs. 10A(a) and 10A(b), it will be seen that a considerable improvement in response can be obtained with the mounting arrangement shown in Fig. 9B.

Subjective tests made upon the effect of the mounting height of the loudspeaker mechanism indicate that the most pleasing results are obtained when the top edge of the loudspeaker mechanism is located near the ear level. Therefore, every effort should be made to mount the loudspeaker as near this level as possible. Since most of the serious listening is done while the listener is seated, the average ear level is 38 to 44 inches. The upper edge of the loudspeaker mechanism in the cabinet of Fig. 6 is about 38 inches above the floor. The mounting height of the loudspeaker mechanism in this cabinet satisfies the mounting height requirements.

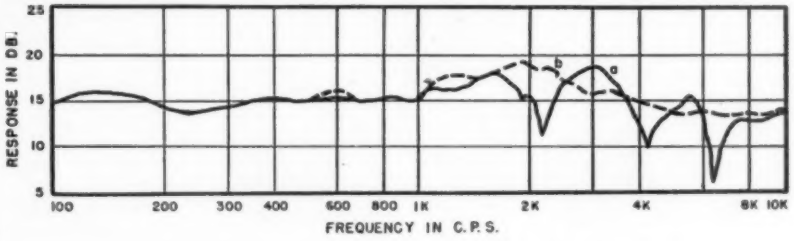
Cabinet Configuration

The outside configuration of the cabinet influences the response due to the diffraction effects introduced by the sharp discontinuities introduced by the edges of the cabinet.

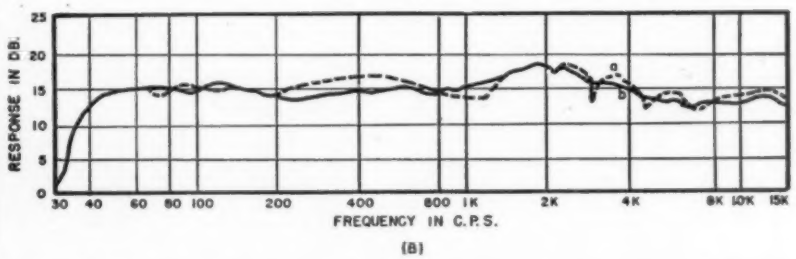
The most common cabinet for mounting loudspeaker mechanisms is a rectangular parallelepiped as shown in Fig. 11. The loudspeaker mechanism is usually mounted near the top end of the cabinet.

The cubic content of the cabinet

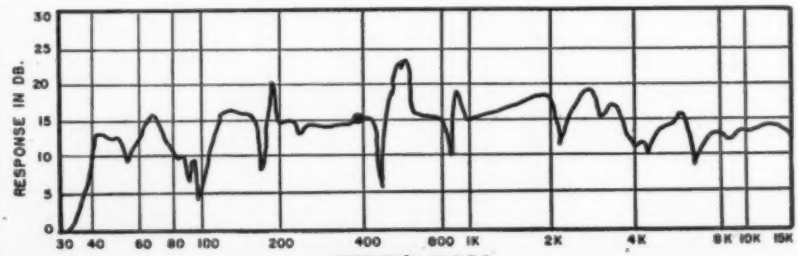
Fig. 10. Response frequency characteristics of a 15" direct radiator loudspeaker mechanism mounted (Aa) as shown in Fig. 9A in the cabinet of Fig. 6; (Ab) as shown in Fig. 9B in the same cabinet. The RCA Types LC1A, 515S1, and 515S2 duo cone loudspeaker mechanisms are designed for flush mounting in the wall of the cabinet. (Ba) Response frequency characteristic with speaker mounted in cabinet of Fig. 11, with cabinet walls made of the same thickness material as shown in Fig. 6. Stiffeners were used on all inside walls. The inside of cabinet was treated with damping material. The loudspeaker was mounted flush with front of cabinet as shown in Fig. 9B. The only essential difference between cabinets of Figs. 6 and 11 is outside shape. (Bb) Response of speaker mounted in cabinet of Fig. 6. (C) Response of same speaker in cabinet of type shown in Fig. 11. In this cabinet design all precautions for obtaining smooth response were purposely ignored to show what the result would be. Deviations from good design included a rectangular parallelepiped outside shape, thin and unbraced walls, untreated inside walls, and speaker mounted on back of front cabinet wall as shown in Fig. 9A.



(A)



(B)



(C)

OUTSTANDING VALUES NOW AVAILABLE

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AUTO ANTENNAS

TOP COWL: 3 section staff, 58" extension. Bakelite insulator, chrome trim. Single hole mount. Simple installation. Complete with lead. **$2.19** each. Case of 25.....**$1.95** each

SIDE COWL: 3 section staff, 63" extension. Complete with tenite insulators. Static ball and tip shielded. Low loss lead.

$1.89 each. Case of 25.**$1.75** each

STANDARD MANUFACTURE VIBRATORS

Standard 4 prong..... **$1.45** each.
10 for.....**$14.00**

Offset 4 prong—Delco type. **$1.55** ea.
10 for.....**$15.00**

Buick type 5 prong.....**$2.95** each.
10 for.....**$28.00**

Generator Condensers.....**25¢** each
10 for.....**$2.20**

BUFFER CONDENSERS

.005 —2000 V...
.006 —1600 V...
.0075—2000 V...
.01 —2000 V...

25¢ each
10 for **$2.25**
100 for **$19.50**

GUARANTEED RECTANGULAR PICTURE TUBES

A real bargain for these first-rate tubes.

16"—16RP4.....**$25.50** each
17"—17BP4.....**$26.50** each
20"—20CP4.....**$45.00** each

PHONO CARTRIDGES—Brand New —Will replace 95% of all cartridges.
1 volt—Standard Mounting.**$1.75** ea.
3 volt—Standard Mounting.**$1.85** ea.

GT TUBE CARTONS

Sturdy—Many Uses

Box bulk tubes, spare parts, nuts and bolts. **79¢** per 100. **$4.95** per 1000.

CHIMNEY MOUNTS—2 piece heavy-duty, rust-proof brackets. No drilling or guy wire needed. Includes strapping. **$1.45** each 12 for **$1.30** each

NOW! LARGE 14" or 17" PICTURE FROM YOUR 10" or 12" TELEVISION SET

Servicemen: Convert customers' sets for extra profits! 90% of all conversions can be made by use of the RAPARCO conversion kit.

14" Kit—14BP4 CR tube, 70° Deflection yoke. Attractive Lucite mask. **$32.95**

17" Kit—17" Rectangular CR tube, 70° Deflection yoke. Attractive Lucite mask, 17" HV Flyback transformer.....**$39.95**

TV COMPONENTS

Standard Manufacture. All New. All Guaranteed.

16" to 19" HV Flyback transformer, Single filament.....**$4.50** ea.
16" to 19" HV Flyback transformer, Double filament.....**$4.50** ea.
GE type 16" to 19" Flyback transformer.....**$4.50** ea.
Vertical Output transformer.**$1.59** ea.
500 MMFD—20 KV.
$1.11 ea., 10 for.....**$10.00**
500 MMFD—10 KV.
79¢ ea.,10 for.....**$7.00**
Single Magnet Ion traps
49¢ ea., 10 for.....**$4.50**
Double Magnet Ion traps
79¢ ea., 10 for.....**$7.50**
.001 MFD—6 KV Condenser
59¢ ea.,10 for.....**$5.50**
.005 MFD—6 KV Condenser
59¢ ea., 10 for.....**$5.50**
14" Attractive Lucite mask, Gold trim.....**$3.95**
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19" Attractive Lucite mask, Gold trim.....**$5.25**
20" Attractive Lucite mask, Gold trim.....**$5.95**

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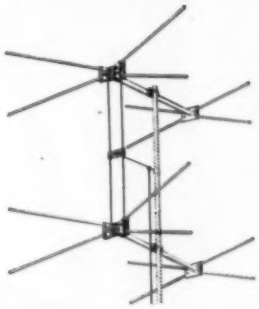
Easily installed. Fine, top quality. Ready to place in your car. Designed for each specific car.

All sets—6 tube. 3 gang; super heterodyne. Extra sensitive circuit. Low battery drain. Beautiful finish and dial. These models now available:

1951—Ford
1949-50—Ford
1951—Chevrolet
1949-50—Chevrolet
1950-51—Studebaker
1948-49-50-51—Hudson
1951—Henry J
1951—Dodge, Plymouth
1949-50—Dodge, Plymouth

List Price, **$59.95**
YOUR PRICE.....**$41.95**

CONICAL TV ANTENNAS



Case of 6 antennas.....**$23.70**
Stacked conicals including stacking bars (as pictured). Case of 3 complete stacks.....**$25.35**
4 ft. TV Antenna Mast—Heavy Gauge Steel —rustproof coating. 1½ OD.
$1.25 each. 10 for.....**$11.50**

INDOOR TELEVISION ANTENNA

Now TV reception without the outdoor antenna. Effective range 20 to 25 miles from station. Excellent reception. Easily installed —takes 5 seconds. Easily orientated. Heavy base—will not tilt. Attractive. Friction clutch-type action on the rods. Complete with lead in.....**$2.49**
Case lots of 25.....**$2.25**

Radio Parts Company, 614 RANDOLPH ST., CHICAGO 6, ILL.

shown in Fig. 11 is approximately the same as that of the cabinet of Fig. 6. The walls of the cabinet were made of the same material as that of Fig. 6. In addition, bracing strips were used on the large flat surfaces. The damping material was the same as that used in the cabinet of Fig. 6. The loudspeaker mechanism was mounted flush with the front of the cabinet of Fig. 11. With these precautions, the essential difference between the cabinets of Figs. 6 and 11 is the outside configuration. The response frequency characteristic of a wide range loudspeaker mechanism mounted in the cabinet of Fig. 11 is shown in Fig. 10B(a). The response frequency characteristic of the same loudspeaker mechanism mounted in the cabinet of Fig. 6 is shown in Fig. 10B(b). The characteristics shown in Figs. 10B(a) and 10B(b) show the deleterious effects of the diffraction from the symmetrical mounting of a loudspeaker mechanism in a rectangular parallelepiped. The physical explanation is as follows: Sound waves spread out in all directions from the loudspeaker mechanism. As the sound waves strike the sharp discontinuity at the edges of the cabinet, they are diffracted. The diffracted waves are sent out in all directions and, depending upon the phase between primary and reflected waves, either add to or subtract from the primary waves produced by the loudspeaker. As a result, corresponding variations in the response are produced due to the interaction between the primary and secondary waves. In the cabinet of Fig. 6 the sharp edge discontinuities have been reduced, which minimizes the reflection and diffraction effects.

As a final check, all of the precautions necessary for obtaining smooth response as outlined in this article

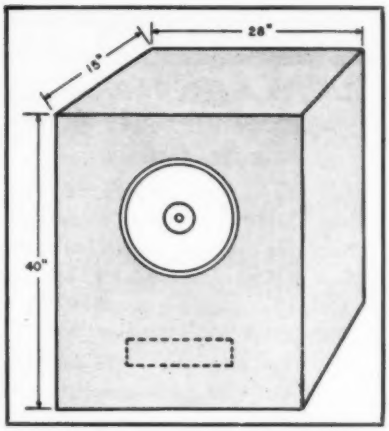


Fig. 11. Perspective view of a cabinet having the shape of a rectangular parallelepiped. The dimensions given yield the same volume as the cabinet shown in Fig. 6.

were purposely ignored to show what the result would be. A wide range loudspeaker mechanism was mounted in a cabinet of the rectangular parallelepiped type shown in Fig. 11. The walls were made of thin wood. The inside of the cabinet was not braced. There was no damping material used on the inside of the cabinet. The loudspeaker was mounted back of the cabinet wall, that is, not flush with the front of the cabinet. The same wide range loudspeaker mechanism used in all the tests reported herein was mounted in this cabinet. The response frequency characteristic obtained on this combination is shown in Fig. 10C. Comparing the characteristics of Figs. 10B(b) and 10C shows that the response of a good loudspeaker mechanism may be ruined by a poorly designed and built cabinet.

-30-

ANOTHER TELEVIEWER BRINGS THEM IN!

ADDITIONAL reports of television reception from distant stations and under unusual conditions continue to drift into our editorial offices, the latest being a log from Harrison King of Savannah Beach, Georgia.

Mr. King's home is approximately 18 miles east of Savannah. The nearest television transmitter is located in Jacksonville, Florida, about 120 miles away. The terrain is flat.

He has a Fada Model TV 30 with an Astatic booster. His antenna, which is mounted on top of a 45 foot roof, is a Vee-D-X, double-stacked and cut for Channel 4. The rotator is an Alliance unit.

-30-

STATION	CITY	DISTANCE	CHANNEL NO.	RECEPTION
WMBR-TV	Jacksonville	120	4	Good
WBTV	Charlotte	210	3	Fair
WAGA-TV	Atlanta	210	5	Fair
WSB-TV	Atlanta	210	8	Fair
WBRC-TV	Birmingham	330	4	Good (on occasion)
WTVJ	Miami	400	4	Good (on occasion)
WNBW	Washington	475	4	Good (on occasion)
WPTZ	Philadelphia	585	3	Good (on occasion)
WNBK	Cleveland	610	4	Good (on occasion)
WWJ-TV	Detroit	680	4	Good (on occasion)
WBNT	New York	650	4	Good (on occasion)
WBEN-TV	Buffalo	700	4	Good (on occasion)
WOC-TV	Davenport	775	5	Fair (on occasion)
WHBF-TV	Rock Island	775	4	Good (on occasion)
WTMJ-TV	Milwaukee	775	3	Fair (on occasion)
WBZ-TV	Boston	820	4	Very good (on occasion)
WNAC-TV	Boston	820	7	Fair (seldom received)
WDAF-TV	Kansas City	825	4	Very good (on occasion)
KRLD-TV	Dallas	845	4	Fair (seldom received)
WKY-TV	Oklahoma City	890	4	Good
WOAI-TV	San Antonio	950	4	Good
WOI-TV	Ames	980	4	Very good (most often received)
WOW-TV	Omaha	960	6	Fair (seldom received)
WTCN-TV	Minneapolis	1020	4	Good (on occasion)

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FREE—SEND FOR OUR LATEST RADIO AND TELEVISION BARGAIN CATALOG

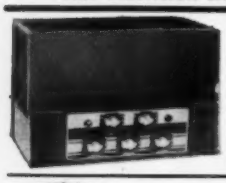
RCA VICTOR NON-BREAKABLE RECORDS INCLUDED. Yes, with the phonograph you get approximately $10.00 worth of RCA Victor non-breakable discs for children. Titles include "Happy the Humbug," "The 500 Hats of Bartholomew Cubbins," "Rapunzel," "Aladdin and His Lamp," etc. Discs are enclosed in beautifully illustrated colored folders giving each story so that the child can follow the recording. Quantity Limited—ORDER NOW!

GIANT COMBINATION DEAL

$10 Worth of RCA Records and Phonograph

$19.97 RA-60

Compact beautifully performing phonograph for all 78 RPM records. Amplifier employs 2 tubes, 50-L-6 and 35-Z-5. Only the finest components are used, such as Alliance Rim-Drive Motor, Astatic Phono arm with L-82 cartridge, PM speaker, full range volume control, etc. The case is decorated with colorful circus figures. Operates on 115v. AC. Weight 11 lbs.



AMPLIFIERS

Latest models. Incorporates dual tone controls for Bass and Treble. Input for crystal, ribbon or dynamic mike and phono. Output Impedances, 4, 8, 15 and 500 ohms. Less tubes.

RA-28 15 Watt Model.... **$21.95**

RA-23 30 Watt Model.... **$34.95**

BUY ALL YOUR RECORDING NEEDS FROM OLSON

STEEL RECORDING WIRE

For all standard wire recorders. Frequency response is excellent. Stainless steel wire.

X-165 ½ hr. spool..... **$1.98**

X-166 1 hr. spool..... **$2.98**

Tape

Fine magnetic recording tape. Frequency response, 50 to 8,600 cycles at 7½" per second. Uniformly coated with red oxide. Available in paper base and plastic base which is stronger. Order your recording tape from Olson. Get the best for less.

Stock No.	Size	Type	Olson's Price, ea.
X-203	¼"x 600 ft.	Paper	$1.35
X-204	¼"x 600 ft.	Plastic	2.10
X-205	¼"x1200 ft.	Paper	3.10
X-206	¼"x1200 ft.	Plastic	3.30

AC LAMP CORD

WHILE THE SUPPLY LASTS

Ever popular brown zip-cord for any AC appliance, lamp or radio. Two conductors, stranded copper, tough insulation.

W-53, 250 ft. spool.....ea. **$4.99**

W-69, 500 ft. spool.....ea. **$8.99**

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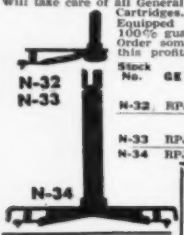
USED IN ALL GE VARIABLE RELUCTANCE CARTRIDGES

No service shop, large or small, should be without a stock of these popular replacement needles. The three types listed below will take care of all General Electric Variable Reluctance Phono Cartridges.

Equipped with GENUINE Sapphire tips. 100% guaranteed. Beautifully packaged. Order some of each today and be ready for this profitable needle replacement business.



Stock No.	GE Type	For Cartridge No.	Tip	Your Cost
N-32	RPJ-001	RPX-040, RPX-041, RPX-046	3 MIL	$2.06
N-33	RPJ-005	RPX-040, RPX-041, RPX-046	1 MIL	$2.06
N-34	RPJ-010	RPX-050	DUAL	$3.50

MUSICAL INSTRUMENT MIKE

M-61 $6.95

Famous quality! Sells for twice our sale price. Easily attached. Delivers brilliant tone from string instruments. With 4' shielded cable and volume control.

ASTATIC PROFESSIONAL

Has all advantages of low pressure design. For Broadcast and Recording Studio use. Ball bearing swivel base, accurately counter balanced arm for one ounce needle pressure. Plays up to 16" discs. Astatics Model No. HP-16. Overall length 15 in. Equipped with Astatic LP-21 cartridge and precious tipped styius. Regular list price $25.00.

Stock No. M-72, each.... **$5.95**

FP CONDENSER KIT

OLSON'S Bargain

AS-24, each **$3.98**

Assortment of 15 popular FP condensers, double and triple sections. Capacities from 10 mfd to 50 mfd; from 25 to 450 volts. Shpg. wt. 3 lbs.

RCA 8" PM SPEAKER

S-123 $3.99 EACH

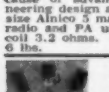
Known as the RCA "Mighty 8." Delivers tremendous volume because of advanced engineering design and super-size Alnico 5 magnet. For radio and PA use. Voice coil 3.2 ohms. Shpg. wt. 6 lbs.

4-DRAWER STEEL CHEST

For small parts, etc. Knob on each drawer; various size compartments.

Each drawer 1¼" deep. Size: 6¼" H., 5⅜" W., 8⅛" D. Shipping weight 5 lbs. **$2.19** X-199

Build a Receiver Set of Basic Components



Kit of 5 parts... AS-38

You get this kit of 5 basic parts to build an AC-TC set or portable: **$1.89**

Parts	Reg. List Price
Loop	$0.95
R. F. Coil	1.10
I.F. Transformer (456 KC) Input	1.60
Output	1.60
Oscillator Coil	.75
List Price of Set	6.00

Use any 365 mfd variable for tuning. Covers 535-1625 KC.

RA-19 PHONO AMPLIFIER

$3.98

Connect to phono or speaker or just the thing for a portable. Uses: 12SQ7, 50L6, 35Z5 tubes. 2 controls: on/off volume and tone. 7"x3¼"x2". Shpg. wt. 2 lbs.

TUBES FOR ABOVE SET, AS-22..... **$2.64**

TV INSTALLATION MEN

If you install TV Antennas, Olson wants you to take advantage of this terrific Antenna Value. High gain Stacked Conical Array with high frequency stubs. Ideal for "Fringe" Area Reception. Sturdily constructed, elements are aluminum. Easily assembled.

This Is a Terrific Value! Each Antenna consists of two conical bays plus a pair of matching Q bars. Less mast. Packed—3 Antennas to a carton. This gives you six bays and 3 pairs of Q bars.

Sold Only in Boxes of 3 Antennas

AU-66. In lots of 3, each..... **$8.66** Carton of 3..... **$25.98** Weight 25 lbs.

POPULAR TV COMPONENTS

These TV parts are made by famous name manufacturers. A lucky purchase makes possible these bargain prices. Stock up now. Each part shown here uses Alnico 5 magnet material which is practically impossible to obtain. Get your share of these scarce components at far less than wholesale.

EM-PM FOCUS COIL

T-90 Special. While they last, each.... $2.98

Latest style combination EM-PM type requiring less power than the straight EM coils. Uses a very heavy Alnico 5 magnet thereby maintaing a more constant focus. This focus coil is used in scores of TV sets including General Electric, Stromberg-Carlsen, Air King and many more. Can be used on all 16"-70° and 19"-66° Kinescopes. Here's real value. Buy now and save. **Because of the shortage of Cobalt these will not be available after our present stock is gone.**

ION TRAP

T-91 Special. While they last, each.... 98¢

Well made ion trap with two powerful Alnico 5 magnets. Exceptionally well made. Bronze spring keeps trap firmly against kinescope neck. **Because of the shortage of Cobalt these will not be available after our present stock is gone.**

QUAM FOCALIZERS

T-89 Special. While they last, each.... $1.98

Genuine Quam-Nichols focalizers, also known as focus magnets. Provides sharp focus relatively independent of regulation in the low voltage power supply. No connections necessary. Widely used in many 1950 models. Utilizes heavy duty Alnico 5 magnet.

UNIVERSAL VIDEO PEAKING COILS

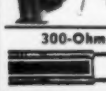
L-39 package of 6 coils with instructions, per pkg.... 98¢

Adjustable from 31 to 820 micro-henrys. No need to carry a big stock of peaking coils if you have a supply of these. Nylon insulated wire. Here's a real Olson value.

Deflection Yoke for use with 10BP4, 12LP4, 16AP4 and all similar kinescopes, same RCA 2001. Wt. 2 #. **T-84, Olson's Price, only....$2.79**

Deflection Yoke for use with kinescopes requiring 70 degree magnetic deflection such as Rectangular 14BP4, 14CP4, 16RP4, 16TP4, 16KP4 and round 16GP4. WT. 2 #. **T-86. Olson's Price, only.....$4.49**

$2.99 **Hi-Voltage Flyback** output transformer for 10" & 12" kinescopes. Provides 9KV. Same as RCA 211T1. WT. 4 #. **T-82. Olson's Price, only.....$2.99**



300-Ohm Lead-in **$4.00** High grade, low loss. For all TV installations. Ship. wt. 3 lbs. **W-68,** 100 ft. coil.

OLSON AKRAD CRYSTAL CARTRIDGES

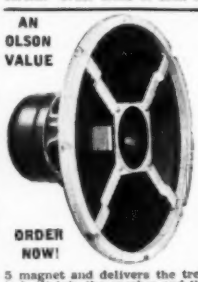
3-VOLT OUTPUT

XC-50, Standard crystal Cartridge, each..... **$1.99**

XC-51, 3-way cartridge with built-in 2 mil needle for 33⅓, 45 and 78 RPM Discs, each..... **$2.79**

The crystal phono cartridge you've been waiting for—and at a price which enables you to use them in your service work profitably. The new Olson Akrad cartridge is interchangeable with any standard cartridge since the mounting centers are ½". Its high output, 3 volts and wide range response of 50-6000 cps are obtained by advanced methods used in driving the crystal element. The cartridge is supplied with pin plug connectors for ease of connecting leads. Each cartridge is individually packed in a handsome red, white, and blue shelf carton. Order some of each model today.

AN OLSON VALUE



ORDER NOW!

12" CO-AXIAL SPEAKER

Woofer-Tweeter design. Response 40 to 17,500 CPS

$13.95 S-160

Months of research went into the design of these high efficiency speakers. The 12" woofer section is driven by a heavy Alnico 5 8 oz. magnet and this part delivers the bass notes. The 3" tweeter which is built into the center of the speaker is driven by a 2.15 oz. Alnico 5 magnet and delivers the treble notes. The high pass filter is built into the speaker and the entire combination gives you tone you never dreamed possible. There are only two wires to connect to any radio or amplifier and the speaker is ready to play for you. Voice coil impedance is 8 ohms. This high quality speaker should not be confused with inferior makeshift units. Olson sells these speakers on an ironclad money-back guarantee if you are not 100% satisfied. Order today. Shpg. wt. 8 lbs.

RCA "FIRE GLOW" FLUORESCENT SIGN

Bigger, brighter, and whiter. The new RCA Fire Glow has high daytime visibility and brilliant luminous white glow at night. The plastic face is three-dimensional, cased in steel. Sign stands on rubber protectors, or can be hung from ceiling with chain supplied. 110 Volt, 60-cycle AC operation. Complete with fluorescent lamp. Shpg. wt. 15 lbs.

2F-985..... **$8.95**

PANEL LAMPS

Westinghouse, GE, and Tung-Sol bayonet panel lamps. 100 of a type to the box.

Stock No.	Type No.	Price per 100
X-161	47	$5.59
X-174	44	
PL-25	81	$4.29

BATTERY ELIMINATOR

MODEL P **$10.95** Each

Converts portable battery sets to all-electric AC. Will give years of dependable, trouble-free service. Supplies 1.4 volts "A" and 90 volts "B" power for 4 to 6 tube sets.

ASTATIC MICROPHONE

High output crystal mike for PA systems and recorders. Equipped with handle base and 7' shielded cable. Shpg. wt.—5 lbs. **$5.95**

M-67, each with on-off switch built into handle... **$6.95**

4 Prong Universal VIBRATORS

Stock No. VB48 **$1.49**

The most popular vibrator in use today. Replaces Mallory 204, 250, 9013M, Radiart 5300, 5301. Size 1¼" dia. by 2⅞" high. Reg. list price **$4.10.** Brand New, individually boxed. Shpg. wt. 8 oz.

PHILCO 1951 AUTO RADIO

FITS ANY CAR OLD OR NEW

OLSON'S GREAT VALUE!

THE ONLY UNIVERSAL ONE-PIECE AUTO RADIO FOR ALL CARS

A brand new Philco 6-tube super-het auto set with 30% more undistorted sound output for rich, clear-voiced volume and greater range. New 3-gang permeability tuner. Built-in interference filtering.

New streamlined design, with slide-rule dial encased in gleaming chrome finish to harmonize with modern cars. Rugged, compact steel case finished in dark blue hammer-type lacquer, has sloping front—neat, attractive, space-saving—out of passengers' way. Installed in a few minutes beneath the instrument panel of the car. Controls are easy to reach and tune . . . yet set is out of the way and virtually out of sight like a built-in part of the car. Complete with tubes, mounting bracket, generator condenser and distributor suppressor. Size: 5¾"x 5⅝"x7¼". Shpg. wt. 20 lbs.

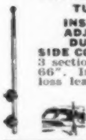
Model CR-501

$34.37

OLSON AKRAD

THE HOUSE OF RADIO AND TELEVISION BARGAINS

AUTO RADIO ANTENNAS

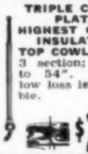


RUSTPROOF BRASS TUBING! INSTANTLY ADJUSTED! DURABLE

SIDE COWL MOUNT

3 section; extends to 66". Includes low loss lead-in cable.

AU-1 **$1.99**



TRIPLE CHROME PLATED HIGHEST QUALITY INSULATORS!

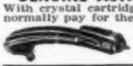
TOP COWL MOUNT

3 section; extends to 54". Includes low loss lead-in cable.

AU-8 **$2.99**

GENUINE ASTATIC PICK-UP ARM

With crystal cartridge . . . at less than you'd normally pay for the cartridge alone.



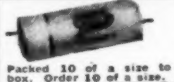
OLSON'S SPECIAL M-58 **$2.99**

HOOK-UP WIRE KIT

How can we give you so much high grade wire for so little? Olson bought all the wire in sight and is passing the bargain on to you. Kit contains 5 rolls, each 100 ft.—total 500 ft. Various colors, push back, plastic and rubber insulation; solid and stranded copper. Shpg. wt. 3 lbs.

AS19, 500 feet **$4.95**

AKRAD TUBULAR ELECTROLYTICS



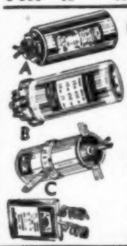
Packed 10 of a size to a box. Order 10 of a size.

No.	Cap.	W.V.	Each
C-136	10	25	$0.25
C-137	25	25	.30
C-138	20	150	.39
C-139	40	150	.45
C-140	20-20	150	.59
C-200	50-30	150	.69
C-141	8	450	.39
C-211	8-8	450	.69
C-142	16	450	.57
C-197	20	450	.69
C-198	30	450	.79
C-199	40	450	.89

Olson "Akrad" Condensers are becoming more widely used by radio servicemen everywhere—and for a good reason! They're made to take hefty surges and overloads and pack a mighty wallop. They cost so little, too! Every "Akrad" condenser is backed by Olson's famous Satisfaction or Your Money Back Guarantee! Always get "Akrad." Compact size with superior characteristics. Easily mounted. Sealed aluminum inner tubes insure maximum life. Tinned copper leads. Give long, trouble-free service.

CLOSE-OUT ENTIRE STOCK!

CORNELL-DUBILIER CONDENSERS



Save big money during Olson's big C-D close-out sale. Over 35,000 brand new shiny electrolytic condensers will be purchased by Olson's customers. Be sure of getting your share. Order early.

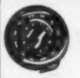
Stock No.	Fig.	Capacity	Volts	Close-out Price
C-530	A	8	450	$0.59
C-510	B	15	300	.29
C-501	B	10-10-20	450-450-25	.39
C-617	B	20-10-10-10	450-450-450-450	.99
C-502	C	32	350	.39

Cornell-Dubilier Paper Filter Block

Hard to get, but Olson has these 4 MFD 400 volt tough condensers. Not Electrolytic. Dry construction throughout. Size 3¼"x2"x1". Reg. list price $2.95.

C-523 Olson's Price, each **49c**

NEW CRYSTAL MIKE



Olson's Special **$4.29** M-71

Nationally famous make. Smart New Design, easy to hold. Used in many tape, wire and disc recorders. Can be used on P. A. systems, amplifiers, etc.

4 Drawer Steel Cabinet FREE with OLSON'S *Gigantic* AKRAD CONDENSER KIT

Olson's Price AS-20 **$16.95**

You get $45.20 (list) worth of "Akrad" condensers plus cabinet, 8½"x7½"x10½".

42 "AKRAD" By-Pass Condensers!

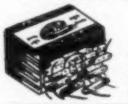
Qty.	Cap.	Volts	List ea.	Total
2	.001	600	$.25	$.50
2	.002	600	.25	.50
2	.005	600	.25	.50
5	.01	600	.30	1.50
5	.02	600	.30	1.50
10	.05	600	.40	4.00
10	.1	600	.45	4.50
2	.005	1600	.55	1.10
2	.008	1600	.55	1.10
2	.01	1600	.60	1.20

27 "AKRAD" Electrolytic Condensers

Qty.	Cap.	Volts	List ea.	Total
2	10	25	$ .75	$1.50
2	25	25	.85	1.70
5	20	150	.95	4.75
5	40	150	1.10	5.50
4	20-20	150	1.30	5.20
5	8	450	.95	4.75
4	16	450	1.35	5.40

69 Total List Value $45.20

10-WATT RESISTOR KIT **$4.95**



RK-2

All wire wound resistors, 10 watt, fully insulated. Long leads. You get 20 resistors ranging from 25 ohms to 25,000 ohms.

FAIRCHILD GRINDER

TL-3 each **$9.98**

Every service shop needs one of these handy tools made by Fairchild, famous manufacturer of precision electric grinders. Regular nationally advertised price is $19.75. The set consists of 1—115 volt high speed, air cooled grinder, 6 assorted grinding wheels, 1 circular saw blade, 1 hardened steel reamer, 1 buffing brush, 1 abrasion stone and a natural finish wood case size 10"x5" x3" to house the grinder. Shipped in original factory sealed cartons.

PHONOGRAPH RECORDS

"TIME TO SLEEP." A 12", 78 RPM, unbreakable disc in album form recorded by World Famous magician Ralph Slater. Designed to put anyone to sleep. Save money. Thousands sold at $3.75. Shpg. wt. 3 lbs.

X-242, your cost per album only.. **$1.29**

3-SPEED PHONOGRAPH

Special **$19.97** RA-56

Complete

Plays 78-45-33⅓ RPM Discs

Finest components in the manufacture of these gorgeously designed phonographs. Features include: 3 speed Alliance motor, heavy flocked turntable, 5-volt output tone arm with precision-tip needle, volume control, 2 tube built-in amplifier, Alnico 5 PM speaker, leatherette covered case with rounded corners, convenient carrying handle. Order early and order enough. Every phonograph 100% guaranteed. Original factory-sealed cartons. Operates 115 volts AC. Shpg. wt. 15 lbs.

GE RPX-040

XC-45 EACH **$3.49**

Variable Reluctance Cartridge with Removable Stylus

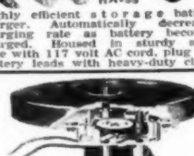
Regular price is $9.95 on this GE Phono Cartridge with removable 3 mil Stylus for 78 RPM discs. Stylus pressure ¾ oz.

BATTERY CHARGER

4 Amps

Olson's Price RA-55 **$8.50**

Highly efficient storage battery charger. Automatically decreases charging rate as battery becomes charged. Housed in sturdy steel case with 117 volt AC cord, plug and battery leads with heavy-duty clips.



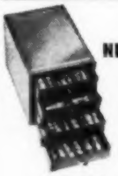
RIM DRIVE PHONO MOTORS

Real bargains. Self-starting; complete with turntable. All parts included. Shpg. wt. 4 lbs.

M-52, 78 rpm for 115 volts AC.......... **$3.79**

M-63, 3-speed, 33⅓, 45 and 78 rpm.......... **$5.99**

OLSON'S GIGANTIC NEW AKRAD KIT —WITH 4-DRAWER STEEL CABINET FREE



Reg. List Price $18.38.

AS-38. Olson's Special Price **$6.95**

We have a limited quantity of Olson Akrad "Super Sealed" by-pass condensers available in 4 drawer steel cabinets, size 6¼x5¾x8⅛. Drawers have compartments. Condensers are designed to give long dependable service even in the tropics.

Kit Contains 42 Condensers

You get the 4 drawer steel cabinet and the following 42 Olson Akrad "Super Sealed" by-pass condensers.

Qty.	Cap.	Volts	Qty.	Cap.	Volts
2	.001	600	10	.05	600
2	.002	600	10	.1	600
2	.005	600	2	.005	1600
5	.01	600	2	.008	1600
5	.02	600	2	.01	1600

IT'S EASY TO ORDER FROM OLSON'S

How to order: Order directly from this ad. For convenience use this order blank. Fill in columns below with quantity desired, stock number, description and price. You may send remittance with order (include enough for postage or parcel post shipment), or if you prefer SEND NO MONEY. Olson will ship C.O.D. and you may pay mail or expressman for merchandise and postage.

MONEY BACK GUARANTEE: *Everything you order from Olson is guaranteed as advertised. If you are not more than satisfied, you may return merchandise for cash refund.*

Please Minimum Order $3.00

QUANTITY	STOCK NUMBER	DESCRIPTION	PRICE EACH	TOTAL

NAME ____________ TOTAL

ADDRESS ____________ ADD POSTAGE

CITY ____________ ZONE ____ STATE ____ TOTAL AMOUNT

RN551

Cut Out and Mail to: OLSON RADIO WAREHOUSE, INC. 73 E. MILL ST. • AKRON 8, OHIO

Emergency Instrument

(*Continued from page 47*)

strument the author didn't spend too much time in "prettying up" the unit as it wasn't designed as a show piece for the workbench. However, this doesn't mean that it is impossible for the instrument to have a "professional" appearance.

If the technician has the time to devote to adding the finishing touches, there are a variety of "extras" that can be included which will add "class" to the front panel.

The builder can apply decals to mark the various ranges of resistance, capacitance, etc., or he can insert white scales behind the range switches and inscribe the appropriate values in India ink on the surfaces. All of these flourishes add immeasurably to the overall appearance of the instrument.

If the unit is to be taken into customers' homes, builders are urged to take the extra time to add these refinements as the customer will be duly impressed by the "professionalism" of the test equipment the technician uses in the servicing of his radio receiver and react accordingly in his relations with the technician.

If by this time you are beginning to believe that we are fond of "Old Faithful" you would be right. The instrument has proven very helpful and always comes through when it is needed most. —30—

Table 1. Details for using instrument for various test functions.

TEST	SECTION	SWITCH	JACKS	PROCEDURE
Capacity (paper cond.)	4	S_{3a}—.001-.01 μfd. S_{3b}—.01-.1 μfd. S_{3c}—.1-1 μfd.	Condenser to A & D Voltmeter to B & C	Plug instrument line cord into line. Close switch S_2. Read meter. (See text)
Condenser Substitution (paper cond.)	3	S_3 to desired range	Test leads to A & B	Disconnect one lead of cond. in receiver and substitute cond. through test leads
Condenser Substitution (electrolytics)	5 or 6	S_4 and/or S_5 to desired range	Test leads to A & B	Disconnect anode of cond. in receiver and substitute cond. through test leads. Observe polarity
Continuity (high res.)	2	S_1 to "b"	Test leads to A & B Phones to C & D	Click in phones indicates continuity
Continuity (low res.)	3	S_3 to any setting	Test leads to C & D	Continuity indicated if lamp lights (See text)
Electrolytic Leakage	1	S_1 to "b". S_2 to "a" for 100 v. cond. or less. S_2 to "b" for over 100 v. cond. S_3 to "b"	Disconnect cond. anode from receiver. Connect + of milliammeter to C. Connect − of milliammeter to cond. anode. Connect disconnected terminal of receiver to A	Turn receiver on. Let cond. form approx. 3 minutes. Throw S_1 to "a". Read milliammeter (See text)
Electrolytic Quality	2	S_1 to "d"	Disconnect anode of cond. from receiver. Connect phones to C & D. Connect cond. to A & B. Observe polarity.	Let cond. form approx. 3 minutes. Remove test lead from cond. cathode. Throw S_1 to "e". Tap neg. terminal of cond. repeatedly with lead. Clicks in phones, gradually disappearing, indicate cond. stores charge
Hum (filter circuit)	5 or 6	S_4 and/or S_5 to desired range	Test leads to A & B	Connect test leads across suspected cond. observing polarity. Reduction in hum suggests defective cond. Confirm by substitution test.
Pilot Lamp 6-8 v. only	2	S_1 to "b"	Test leads to A & D	Test leads to lamp. Lamp should light
Resistor Substitute	3	S_3 to desired range	Test leads to A & B	Disconnect one end of resistor in receiver and substitute resistor through test leads
Signal Generator	7	S_{1b} to "b"	Coaxial cable probe to A	Touch probe to signal circuits of stages, working from speaker to antenna. Signal will be heard in speaker if following parts of stages are OK
Signal Tracer (audio)	1	S_1 to "a", S_2 to either setting, S_3 to "b"	Phones to C & D Chassis to A Test probe to B	Touch probe to signal circuits in audio stage. If r.f.-i.f. stages are known to be OK, signals will be heard in phones if preceding parts of audio stage (s) are OK
Signal Tracer (audio)	2	S_1 to "c"	Same as above	Same as above
Signal Tracer (r.f.-i.f.)	2	S_1 to "a"	Phones to C & D Chassis to B Test probe to A	Touch probe to signal circuits in r.f.-i.f. stages. Signals are heard in phones if preceding parts of r.f.-i.f. stages are OK
Speaker Substitute	1	S_1 to "a", S_2 to either setting, S_3 to "a"	Secondary of receiver's output trans. to A & B. Disconnect one end of secondary from receiver's speaker	Substitute speaker will "take over".

FIX ANY RADIO

Amazing New Invention

Find radio faults with a new simplified method. Repair all radios in minutes instead of hours. Revolutionary, different **Comparison** technique permits you to do expert work almost immediately. Most repairs can be made without test equipment. Simplified point-to-point, cross-reference, circuit suggestions locate faults quickly and easily.

PRICE ONLY $1.50 COMPLETE

NO TESTERS NEEDED

This newly developed method tells you how to locate the source of trouble in any radio set without equipment. Make needed tests, measure voltage, trace the signal, by using only a 5¢ resistor, small condenser, and a crystal detector. Inject signals without any signal generator. Test parts by the new **Comparison** method. Test tubes without equipment. Repair any radio expertly following simplified picture plans. Improve your radio servicing ability. Data on all sets, portables, FM, AC-DC, P.A., recorders, T-V. Send coupon below.

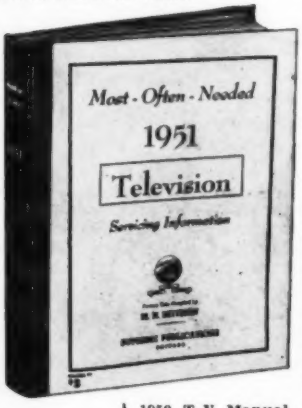
CHARTS, BLUE-PRINTS, TESTS

Learn time-saving trouble-shooting short-cuts; find any radio fault with ease. Follow the tests shown on 24 large circuit blue-prints. Gives over 1,000 practical repair hints. For all types of radios. Hundreds of simplified tests using a 5¢ resistor and any filter condenser. Introductory material to help beginners. Several chapters on test equipment. Complete plan in manual form, 61 job-sheets, data on all tubes, 92 large pages, 8½x11 in. Schematics, pictures, charts. Sold on no-risk trial. Price, only $1.50. Use coupon below.

New TELEVISION *MANUALS*

MOST AMAZING MONEY-SAVING BARGAINS

The **television series** manuals are the most remarkable values offered by **Supreme Publications** in their 17 years of business. These TV manuals at only $3 and $2 each are amazing bargains and defy competition. There is nothing else like them. Each manual is a virtual treatise on practical television repairs. By normal standards, each such large manual packed as it is with practical facts, hundreds of illustrations, diagrams, charts, photographs, and expensive extra-large blueprints, should sell for $10—but as SUPREME special values they are priced at $3 and $2 each. Only a publisher who sold over one million TV and radio manuals can offer such bargains based on tremendous volume-sales.



New 1951 TV *Manual*

This newest giant volume of the series covers 1951 television factory data. Here is everything you need to repair and adjust all present day TV sets. Covers all popular makes from Admiral to Zenith. There are circuit explanations, 192 pages of alignment procedure, many test patterns, response curves, pages of waveforms, voltage charts, service hints, factory recommended changes, and dozens of double-page diagrams. Manual-style binding, large size: 8½ x 11". Available at your radio jobber or postpaid. See no-risk trial coupon below. Price postpaid, or at your jobber, only **$3**

Compiled by M. N. Beitman, radio engineer, teacher, author & serviceman.

1950 T-V Manual. Includes service material on all popular TV sets of 1950 period. Large size: 8½x11", plus ten mammoth 11x15" blueprints. Manual-style binding. A bargain at only.... **$3**

1949 T-V Manual. Similar to volumes listed above. Has 192 extra-large pages, plus 9 double-spread giant blueprints. To order see coupon below. **$3** Available also at all jobbers. Only.....

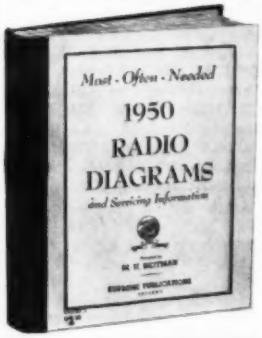
1948 T-V Manual. Earlier volume has material on all popular T-V sets of this period. Large size: 8½x11". Remarkable value. Including 8 fold-out blueprints. Servicemen's price only..... **$3**

1947 FM and T-V Manual. Covers all needed FM and television sets including popular R.C.A. 630TS. Size: 8½x11". Data on 192 pages. Flexible covers. Remarkable value at only..... **$2**

Supreme Publications

Sold by All Leading Radio Jobbers

SUPREME RADIO *MANUALS*



New 1950 Radio Diagrams

Now you can benefit and save money with **Supreme** amazing manual scoop. This one giant volume has all the service data you need on all recent radio sets. Here you have clearly-printed large schematics, needed alignment data, parts lists, voltage values, and information on stage gain, location of trimmers, and dial stringing illustrations. This is the help you need to find tough faults in a jiffy. The new 1950 radio manual is a worthy companion to the 9 previous volumes used to an advantage by over 128,000 shrewd radio men.

BIGGEST BARGAIN IN SERVICE DATA

Wise servicemen know that **Supreme Publications** manuals have all the material needed at the lowest prices. For the remarkable bargain price (only $2 for most volumes) you are assured of having on hand needed diagrams and all other essential repair facts on almost all sets you will ever service. Every popular radio of all makes, from old-timers to new 1950 sets is covered. Select manuals wanted, see list below.

SUPREME RADIO MANUALS for PREVIOUS YEARS

1949 1948 1947 1946 1942 1941 1940 1939

SUPREME Most-Often-Needed RADIO DIAGRAMS Each Manual only $2. (1949 is $2.50); 192 pages of diagrams, alignment data, voltage values, parts lists, and service hints; large size, 8½"x 11". To order, see coupon below.

1926-1938 RADIO Diagrams 240 Pages Price $2.50

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SUPREME PUBLICATIONS, 3727 W. 13 St., Chicago 23, ILL.

Send the manuals checked below and at right. You guarantee satisfaction or money back.

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- ☐ **New 1951 Television Service Manual . . . . $3.**
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Most-Often-Needed Radio Diagram Manuals

- ☐ *New* 1950 Manual, $2.50
- ☐ 1949 Radio Manual, $2.50
- ☐ 1948
- ☐ 1947
- ☐ 1946
- ☐ 1942
- ☐ 1941
- ☐ 1940
- ☐ 1939

RADIO MANUALS — **PRICED AT ONLY $2 EACH**

- ☐ 1926-1938 Manual, $2.50

Superior's New Model 770

AN ACCURATE POCKET-SIZE
VOLT-OHM MILLIAMMETER

(SENSITIVITY—1000 OHMS PER VOLT)

FEATURES: Compact—measures 3⅛" x 5⅞" x 2¼". Uses latest design 2% accurate 1 Mil. D'Arsonval type meter. Same zero adjustment holds for both resistance ranges. It is not necessary to readjust when switching from one resistance range to another. This is an important time-saving feature never before included in a V.O.M. In this price range. Housed in round-cornered, molded case. Beautiful black etched panel. Depressed letters filled with permanent white, insures long-life even with constant use. **SPECIFICATIONS: 6 A.C. VOLTAGE RANGES:** 0—15/30/150/300/1500/3000 VOLTS. **6 D.C. VOLTAGE RANGES:** 0—7.5/15/75/150/750/1500 VOLTS. **4 D.C. CURRENT RANGES:** 0—1.5/15/150 MA. 0—1.5 AMPS. **2 RESISTANCE RANGES:** 0—500 OHMS 0—1 MEGOHM.

The Model 770 comes complete with self-contained batteries, test leads and all operating instructions.

$14.90 NET

Superior's New Model 670

SUPER-METER

***A COMBINATION* VOLT-OHM MILLIAMMETER PLUS CAPACITY REACTANCE INDUCTANCE AND DECIBEL MEASUREMENTS**

SPECIFICATIONS:

D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500/7,500 Volts
A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5 Amperes
RESISTANCE: 0 to 500/100,000 Ohms 0 to 10 Megohms
CAPACITY: .001 to .2 Mfd. .1 to 4 Mfd. (Quality test for electrolytics)
REACTANCE: 700 to 27,000 Ohms 13,000 Ohms to 3 Megohms
INDUCTANCE: 1.75 to 70 Henries 35 to 8,000 Henries
DECIBELS: — 10 to + 18 + 10 to + 38 + 30 to + 58

ADDED FEATURE:

The Model 670 includes a special GOOD-BAD scale for checking the quality of electrolytic condensers at a test potential of 150 Volts.

The Model 670 comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions. Size 5½" x 7½" x 3".

$28.40 NET

Superior's New Model TV-11

TUBE TESTER

Specifications

- Tests all tubes including 4, 5, 6, 7, Octal, Lock-in, Peanut, Bantam, Hearing-aid, Thyratron, Miniatures, Sub-Miniatures, Novals, Sub-Minars, Proximity Fuse Types, etc.
- Tests for "shorts" and "leakages" up to 5 Megohms.
- Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin-number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TV-11 as any of the pins may be placed in the neutral position when necessary.
- The Model TV-11 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket.
- Free-moving built-in roll chart provides complete data for all tubes.
- Newly designed Line Voltage Control compensates for variation of any line voltage between 105 Volts and 130 Volts.

EXTRA SERVICE

The Model TV-11 may be used as an extremely sensitive Condenser Leakage Checker. A relaxation type oscillator incorporated in this model will detect leakage even when the frequency is one per minute.

***NOISE TEST**

Phone Jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose external connections.

The Model TV-11 operates on 105-130 volt 60 Cycles A.C. Comes housed in a beautiful hand-rubbed oak cabinet complete with portable cover. Size 11½" x 13" x 6". Shpg. wt. 15 lbs.

$47.50 NET

USE CONVENIENT RUSH ORDER FORM ON OPPOSITE PAGE →

GENERAL ELECTRONIC DISTRIBUTING CO.

DEPT. RN-5, 98 PARK PLACE NEW YORK 7, N. Y.

Superior's New Model TV-20

Ultra H. F. Voltmeter Probe converts Model TV-20 into Negative Peak-Reading H. F. Voltmeter.

20,000 OHMS PER VOLT MULTI-METER and TELEVISION KILOVOLTMETER

The Model TV-20 was designed to provide all the multi-meter measurement requirements of A. M., F. M. and Television. Unlike other recent models, which are actually standard V.O.M.'s converted to test the new Television Voltages, the Model TV-20 is a completely new unit. It provides the sensitivity, ranges and accessories which are needed to service F. M. and Television in addition to A. M. Radio. The High Voltage Probe for example, with a range of 50,000 volts and designed to withstand 100,000 volts, is an integral part of the instrument with a special compartment for housing it when not in use.

SPECIFICATIONS

- 9 D. C. VOLTAGE RANGES: (At 20,000 ohms per Volt) 0-2.5/10/50/100/250/500/1,000/5,000/50,000 Volts
- 8 A. C. VOLTAGE RANGES: (At 1,000 ohms per Volt) 0-2.5/10/50/100/250/500/1,000/5,000 Volts
- 5 D. C. CURRENT RANGES: 0-50 Microamperes, 0-5/50/500 Milliamperes, 0-5 Amperes
- 4 RESISTANCE RANGES: 0-2,000/20,000 ohms, 0-2/20 Megohms
- 7 D. B. RANGES: (All D. B. ranges based on ODb = Mv. into a 600 ohm line)

— 4 to + 10 db	+ 22 to + 36 db	+ 36 to + 50 db	+ 48 to + 62 db
+ 8 to + 22 db	+ 28 to + 42 db	+ 42 to + 56 db	

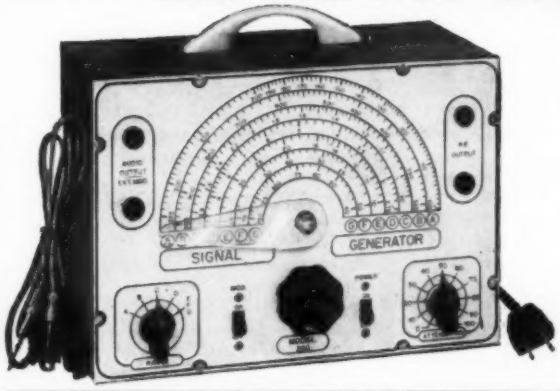
- 7 OUTPUT VOLTAGE RANGES: 0 to 2.5/10/50/100/250/500/1,000 Volts

The Model TV-20 operates on self-contained batteries. Comes housed in beautiful hand-rubbed oak cabinet complete with portable cover, Built-In High Voltage Probe, H. F. Probe. Test Leads and all operating instructions. Measures 4½" x 10¼" x 11½". Shipping Weight 10 lbs.

$39.95 NET

The New Model 200

AM and FM SIGNAL GENERATOR



SPECIFICATIONS

★ **R.F. FREQUENCY RANGES:** 100 Kilocycles to 150 Megacycles.

★ **MODULATING FREQUENCY:** 400 Cycles. May be used for modulating the R.F. signal. Also available separately.

★ **ATTENUATION:** The constant impedance attenuator is isolated from the oscillating circuit by the buffer tube. Output impedance of this model is only 100 ohms. This low impedance reduces losses in the output cable.

★ **OSCILLATORY CIRCUIT:** Hartley oscillator with cathode follower buffer tube. Frequency stability is assured by modulating the buffer tube.

★ **ACCURACY:** Use of high-Q permeability tuned coils adjusted against 1/10th of 1% standards assures an accuracy of 1% *on all ranges from 100 Kilocycles to 10 Megacycles* and an accuracy of 2% on the highest frequencies.

★ **TUBES USED:** 12AU7—One section is used as oscillator and the second is modulated cathode follower. T-2 is used as modulator. 6C4 is used as rectifier.

The Model 200 operates on 110 Volts A.C. Comes complete with output cable and operating instructions.

$21.85 NET

Superior's New Model TV-30

TELEVISION SIGNAL GENERATOR

ENABLES ALIGNMENT OF TELEVISION I. F. AND FRONT ENDS WITHOUT THE USE OF AN OSCILLOSCOPE!

FEATURES Built-in modulator may be used to modulate the R. F. Frequency, also to localize the cause of trouble in the audio circuits of T. V. Receivers.

Double shielding of oscillatory circuit assures stability and reduces radiation to absolute minimum. All I. F. frequencies and 2 to 13 channel frequencies are calibrated direct in Megacycles on the Vernier dial. Markers for the Video and Audio carriers within their respective channels are also calibrated on the dial.

Stability assured by cathode follower buffer tube and double shielding of component parts.

SPECIFICATIONS Frequency Range: 4 Bands — No switching; 18-32 Mc., 35-65 Mc., 54-98 Mc., 150-250 Mc.

Audio Modulating Frequency: 400 cycles (Sine Wave). Attenuator: 4 position, ladder type with constant impedance control for fine adjustment.

Model TV-30 comes complete with shielded co-axial lead and all operating instructions. Measure 6" x 7" x 9".

$33.95 NET

MONEY BACK GUARANTEE!!

GENERAL ELECTRONIC DISTRIBUTING CO. DEPT. RN-5, 98 PARK PLACE, NEW YORK 7, N. Y.
Phone—REctor 2-1677

GENTLEMEN: PLEASE RUSH THE MATERIAL LISTED BELOW:

QUANTITY	MODEL	PRICE	TOTAL

Name_____

Address_____

City_____ Zone_____ State_____

$_____ (Payment in Full Enclosed)

$_____ (Deposit Enclosed — Ship Balance C.O.D.)

Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO & TELEVISION NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

SYNCHRONOUS GENERATORS

A new 4-page, two-color bulletin describing the company's "Tri-Clad" high speed synchronous generators is currently being offered by *General Electric Company*, Schenectady 5, New York.

The publication, GEA-5470, covers generators for standby, portable, and prime source power in ratings from 1.875 to 50 kva. with frequencies of 60 and 400 cycles. Four designs are described in the bulletin—the externally-regulated, self-regulated, and packaged-regulated 4-pole synchronous generators, and the high frequency 14-pole synchronous generator.

The bulletin lists all of the salient features of the units and provides over-all, cut-away, and exploded views of the generators.

VEE-D-X CATALOGUE

The LaPointe-Plascomold Corporation of Windsor Locks, Conn. has issued its 1951 catalogue which lists the company's complete line of "Vee-D-X" television antennas and accessories.

Along with technical, installation, and ordering data on all antennas, the catalogue contains general information of interest to the trade. Considerable space has been devoted to such products as the company's lightning arrester, a three-way switch box, the new "Mighty-Match," and television towers.

Copies of Catalogue 51 may be obtained by writing the company direct.

V.T.V.M.'S IN SERVICING

The Radio Tube Division of *Sylvania Electric Products Inc.*, 1740 Broadway, New York 19, New York has issued a new 48-page booklet containing comprehensive information on the use of vacuum tube voltmeters in radio and television servicing.

The booklet is divided into five chapters of concise instructive text describing different types of v.t.v.m.'s, their adjustment, and application in radio receiver tests and measurements, audio amplifier tests and measurements, television receiver tests, and in miscellaneous applications.

Copies of the booklet are being given without charge to dealers purchasing a *Sylvania* TV picture tube through any of the company's authorized distributors between this date and May 31, 1951. After that date copies of the booklet will be available at $1.00 per copy.

TECHNICAL DATA

The Amplifilm Division of *Aircraft-Marine Products Inc.*, 1340 N. Fourth Street, Harrisburg, Pa. has issued a technical data sheet covering its line of "Capitron" high voltage condensers and pulse forming networks.

Since these units employ a new dielectric material, tradenamed "Amplifilm", some of the more pertinent details on this product are also included on the data sheet.

A copy of Bulletin AD-1 is available on request. Persons desiring more complete data on "Amplifilm" should also request a copy of Bulletin AD-2 the "Amplifilm Dielectric Sheet" publication.

G-E REPLACEMENT PARTS

A new television and radio replacement parts catalogue, listing parts for sets produced from 1945 to December 1, 1950, is currently being sent to distributors by the Receiver Division of *General Electric Company*, Syracuse, New York.

The cloth-covered, 144-page, loose-leaf catalogue features a cross reference between drawing number and part number, making it possible to determine from the drawing alone, all the information about any part. This is a new feature of the catalogue.

Further features include an alphabetical listing by parts number, new and complete part descriptions, set models in which each part is used, list price, and a revision service to keep salesmen up-to-date.

TV ACCESSORIES

Of interest to television technicians is the new television antenna and accessories catalogue recently published by *JFD Manufacturing Co., Inc.* of 6101 Sixteenth Avenue, Brooklyn 4, New York.

Designated Catalogue No. 58G, the new publication carries a complete listing of the company's line of television antennas, brackets, mounts, screw eyes, lightning arresters, indoor antennas, masts, insulators, transmission lines, guy and ground wire, etc. New listings include data on the company's "Long-Ranger" yagi antenna line.

Copies of the catalogue may be obtained either direct from the company or from the company's distributors.

TERMINALS AND CONNECTORS

The Thomas & Betts Co., Elizabeth 1, New Jersey has issued a comprehensive catalogue covering pressure terminals and connectors for all types of applications on all wire sizes from #26 through 250 MCM.

Listed in convenient, easy-to-find form, the new "Sta-Kon" Bulletin No. 61 provides a complete list of Armed

GET YOUR NEW hallicrafters COMMUNICATION RECEIVER HERE and

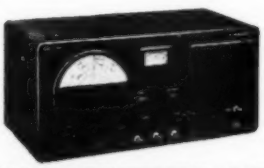
Save Money With a "Surprise" Trade-In Allowance on Your Used Test and Communication Equipment

For super dooper savings on Hallicrafters Receivers get a Walter Ashe "SURPRISE" Trade-In offer on your used (factory-built) Test Instruments or Communication Equipment. Walter will give you an extra-liberal allowance that will put the Hallicrafters model of your choice within easy reach! So don't delay! Get *your* trade-in deal working today. Wire, write, phone or use the handy coupon below.

HALLICRAFTERS SX-71

Shpg. wt. 33 lbs.....**Only $199.50**

For the very thriftiest way to buy your new SX-71, trade your used equipment. Profit with a "Surprise" trade in!
R-46 Spkr. .....Only **$19.95**



HALLICRAFTERS S-77

Improved AC-DC version of the famous S-40B—the world's most popular Ham receiver. And with a "Surprise" trade-in you can save plenty. With built-in spkr.

Shpg. wt. 32 lbs.....**Only $99.95**

Wherever You May Roam . . .

Keep The Home Ties With The S-72, Long-Range Portable

Soldier, sailor, marine, businessman, diplomat, world traveler, explorer—wherever you are . . . no matter where you go . . . you'll always be just "around the corner" from home with this extra-sensitive, portable broadcast-short wave radio. Plenty of sensitivity for far-distant stations, even where ordinary receiving sets fail. Can be used on 110-120 volt AC or DC or self-contained batteries.

HALLICRAFTERS S-72 Shpg. wt. 16 lbs. Only **$109.95** (less battery)

HALLICRAFTERS S-76

Apply our liberal "Surprise" trade-in allowance against the above price. What have you got to trade?

Shpg. wt. 44 lbs. .....**Only $169.50**

R-46 Spkr. .....Only **$19.95**

All prices f.o.b. St. Louis
Phone CHestnut 1125

NOVICE AND TECHNICIAN LICENSES

Available July 1st

Get the right start in amateur radio with a "Surprise" Trade-in Allowance, available only at Walter Ashe, headquarters for Hallicrafters Precision Radio — famous throughout the world.

FREE!

New 1951 catalog. The "treasure chest" of values in everything in Radio and Electronics.

Walter Ashe RADIO CO.
THE HOUSE OF "SURPRISE" TRADE-INS
1125 PINE ST. • ST. LOUIS 1, MO.

Walter Ashe Radio Co.
1125 Pine St., St. Louis 1, Mo. RN-51-5

☐ O. K. Walter, *Rush* "Surprise" Trade-in offer on my .....
(describe used equipment)
for .....
(show make and model No. of new equipment desired)
☐ Rush Free Copy of your new 164 page Catalog.
NAME .....
ADDRESS .....
CITY..... Zone..... STATE.....

SEND FOR YOUR COPY TODAY!

Forces procurement numbers with the corresponding company catalogue numbers. This feature is expected to be of help to those selecting and purchasing fittings for aircraft and naval wiring and for ground force equipment.

The pages carrying specific types of "Sta-Kon" connectors and terminals give complete dimensions in simplified tabular form, along with full information on UL and Armed Forces approvals. Mechanical drawings and information on type of installing tools required are also included.

Requests for copies of Bulletin No. 61 must be made on company letterhead.

CONDENSED CATALOGUE

Furst Electronics of 12 S. Jefferson Street, Chicago 6, Illinois has just issued a condensed catalogue which carries details on the company's line of regulated power supplies, a new wide-band d.c. amplifier, and a new wow meter.

Information on this equipment is presented in tabular form and each unit is illustrated by a photograph. Nine different models of electronically-regulated power supplies are covered as are the Model 120 d.c. amplifier, the Model 115-R wow meter, and the Model 910 klystron power supply.

Copies of this new catalogue are free on request.

"TELETOWERS"

A four-page booklet which lists the advantages of "Teletowers" has been issued by *Penn Boiler & Burner Mfg. Corp.* of Lancaster, Pa.

The colorful brochure points out the special features of this television mast by means of cartoon-type figures and actual photographs.

A copy of the booklet is available without charge from the company.

NEEDLE DISPLAY CASE

The Accessory Division of *Philco Corporation*, Philadelphia 34, Pa. has recently released a new phonograph needle display merchandiser which has been designed to help dealers and technicians sell *Philco* needles.

The new merchandiser, which contains a rear drawer holding 48 individually packaged needles, displays one needle of each type in a tamper-proof, clear-view package on top of the unit. The company's 1951 line includes ruby, sapphire, long-life, and high-quality phonograph needles. Customers can read the advantages of each type of needle below the display package. Although the merchandiser takes up only a few square inches of counter space, it does a big job in helping customers select the proper needles for their individual needs.

INSTRUMENT DATA

El-Tronics Inc. of 2647-67 N. Howard Street, Philadelphia 33, Pa. is currently offering copies of its Bulletin No. 502 to interested persons.

The new data sheet provides specifi-

PARTS and TUBES

ORDER from "PREMIER"
Your reliable source since 1926

TUBES—Radio and TV

INDIVIDUALLY BOXED—STANDARD FACTORY GUARANTEE

1U4	$1.00	6B4G	$1.60	6S8GT	$1.32	7F7	$1.10	12SQ7	$0.75	25Z6G	$1.32
1US	.90	6B5	1.60	6SA7	1.00	7F8	1.32	12SQ7GT	.83	36	1.32
1V	1.10	6B6G	1.10	6SA7GT	1.00	7G7	1.32	12SR7	1.10	37	.90
1X2A	1.32	6B7	1.60	6SB7Y	1.20	7H7	1.32	12SR7GT	.83	39/44	1.32
2A3	1.60	6B8GT	1.60	6SC7	1.00	7J7	1.32	12Z3	1.32	41	.83
2A5	1.10	6BA6	.90	6SD7GT	1.45	7K7	1.32	14A4	1.32	42	.83
2A6	1.32	6BA7	1.80	6SF5	.83	7L7	1.32	14A5	1.60	43	.83
2A7	1.32	6BC5	1.00	6SF5GT	.83	7M7	1.10	14A7	1.20	45	.83
2K5	1.32	6BC7	1.10	6SF7	1.00	7Q7	.90	14AF7	1.20	45Z5GT	.90
3A8GT	2.40	6BD5GT	1.60	6SG7	1.00	7R7	1.10	14B8	1.10	46	1.32
3B7/1291	1.32	6BE6	.90	6SH7	1.10	7S7	1.32	14B8	1.10	50	1.20
3C6	1.60	6BF5	1.10	6SH7GT	1.10	7V7	1.32	14C5	1.32	50	1.98
3E6	1.32	6BF6	.83	6SJ7	.90	7W7	1.32	14C7	1.20	50A5	1.10
3LF4	1.32	6BG6G	2.40	6SJ7GT	.90	7X6	1.10	14E6	1.32	50B5	1.00
3Q4	1.10	6BH6	1.00	6SK7GT	1.00	7X7	1.32	14E7	1.32	50C5	1.00
3QSGT	1.20	6BJ6	1.00	6SL7GT	1.20	7Y4	.90	14F7	1.10	50C6G	1.45
3S4	1.00	6BN6	1.60	6SN7GT	1.10	7Z4	.90	14F8	1.10	50L6GT	.83
3V4	1.00	6BQ7	1.60	6SQ7	.78	10	1.95	14H7	1.20	50X6	1.10
5T4	1.95	6C4	.83	6SQ7GT	.83	12A	.68	14J7	1.32	50Y6GT	.90
5U4G	.83	6C5GT	.83	6SR7GT	.90	12A6	.75	14N7	1.32	50Y7GT	1.60
5V4G	1.20	6C6	1.00	6SS7	.90	12A7	1.60	14Q7	1.10	55	1.10
5W4	.83	6C8G	1.60	6T7G	1.10	12A8GT	1.00	14R7	1.32	56	.90
5W4GT	.83	6C8G	1.00	6T8	1.60	12AH7GT	1.32	14X7	1.32	57	1.00
5X4G	.90	6CD6G	3.00	6U4GT	1.32	12AT6	.90	17Y4	1.20	58	1.00
5Y3GT	.64	6D6	1.00	6U5	1.00	12AT7	1.45	19BG6G	3.00	59	1.76
5Y4G	.75	6D8G	1.60	6U6GT	1.00	12AU6	1.00	19J6	1.60	70L7GT	1.98
5Z3	.90	6E5	1.10	6U7G	.90	12AU7	1.20	19T8	1.45	71A	1.00
6A4/LA	1.32	6F5GT	.83	6V6GT	1.00	12AV6	.76	20	1.45	75	.83
6A3	1.60	6F6GT	.83	6V7G	.90	12AV7	1.60	22	1.60	76	.83
6A4	1.60	6F8G	1.60	6W4GT	.90	12AW6	1.32	24A	1.10	77	.83
6A5G	.95	6G6G	1.32	6W6GT	.90	12AX7	1.20	25A6	1.32	78	.83
6A7	1.00	6H4GT	1.32	6X4	.75	12BA6	.90	25A7GT	3.00	79	1.32
6A8GT	1.00	6H6	.83	6X5GT	.75	12BA7	1.20	25AC5GT	1.45	80	.68
6AB4	1.00	6H6GT	.83	6Y6G	1.20	12BE6	.90	25BQ6GT	1.60	81	1.95
6AB5/6N5	1.32	6J5GT	.75	6Y7G	1.60	12BF6	1.32	25C6G	1.45	83	1.32
6AB7	1.60	6J6	2.42	6Z4Y5G	1.10	12BH7	1.20	25D8	1.95	83	1.32
6AC5GT	1.45	6J7G	1.00	7A4	1.00	12BR8	1.00	25L6GT	.90	84	.90
6AC7	1.45	6J8G	1.60	7A5	1.00	12F5GT	.90	25W4GT	1.90	85	1.10
6AD7G	1.60	6K5GT	1.20	7A6	.90	12H6	.90	25Y5	1.45	89Y	1.10
6AF6G	1.32	6K6GT	.83	7A7	.90	12J5GT	.75	25Z5	1.32	117L7	1.98
6AG5	1.32	6K7G	.83	7A8	.90	12K7GT	.83	25Z6GT	.75	117M7GT	1.95
6AG7	1.60	6K7GT	.83	7AD7	1.60	12Q7GT	.90	26	.90	117P7GT	1.95
6AH6	1.95	6K8	1.20	7AF7	.90	12SA7GT	1.32	27	.75	117Z3	.75
6AL5	.95	6K8GT	1.20	7AT7	1.10	12SC7	1.00	30	1.00	117Z6GT	1.20
6AK6	1.20	6L5G	1.32	7AH7	1.10	12SA7GT	1.00	31	1.32	VR150	1.50
6AL5	1.00	6L6	1.76	7B4	.90	12SC7	1.10	32L7GT	1.60	4828	1.20
6AL7GT	1.32	6L6G	1.76	7B5	.90	12SF5GT	1.00	33	1.60	4837	1.20
6AQ5	1.00	6L6GA	1.76	7B6	.90	12SF7	1.00	35/51	1.00	5591	1.20
6AQ6	.90	6L7	1.20	7B7	.90	12SG7	1.00	35A5	.90	807	1.50
6AQ7GT	1.20	6N6G	1.45	7B8	.90	12SH7	1.10	35B5	1.00	813	9.95
6AR5	.83	6N7GT	1.20	7C5	1.00	12SK7GT	1.10	35C5	1.00	1619	.95
6AS5	1.00	6P5GT	1.20	7C6	.90	12SJ7	.90	35L6GT	.90	1622	1.75
6AT6	.75	6Q7	1.00	7C6	.90	12SJ7GT	.90	35W4	.64	2050	1.75
6AU6GT	1.32	6Q7GT	.90	7C7	.90	12SK7	.90	35Y4	.80	2051	1.25
6AU6	1.00	6R7GT	1.32	7E5	1.32	12SK7GT	1.00	38Z3	.90	7193	1.20
6AV6	.75	6S4	.90	7E6	1.10	12SL7GT	1.20	35Z4GT	.75	VT51	.30
6AX5GT	.68	6S7GT	1.60	7E7	1.32	12SN7GT	1.10	35Z5GT	.75	VT52	.30

0Z4	$0.83
0Z4G	.83
1A5GT	.90
1A6	1.60
1A7GT	1.00
1B3GT	1.32
1C5GT	1.10
1C6	1.60
1C7G	1.60
1D5GT	1.95
1D7G	1.60
1D8GT	1.95
1F4	1.32
1F5G	1.32
1G4GT	1.32
1G6GT	1.32
1H5GT	.83
1H6G	1.60
1J5G	1.32
1J6G	1.60
1J6GT	1.60
1L6	1.32
1LA4	1.32
1LA6	1.32
1LB4	1.32
1LC5	1.32
1LC6	1.32
1LD5	1.32
1LE3	1.32
1LG5	1.32
1LN4	1.32
1LN5	1.32
1N5GT	1.00
1P5GT	1.32
1Q5GT	1.32
1R5	1.00
1S5	.90
1T4	1.00
1Y5GT	1.32

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A beautiful antenna which is the ultimate in reception, highest signal gain, nothing to adjust.
List price $9.95 ..... Each **$4.78**

TV Antennas:

Twin V Antenna with 8-ft. mast $6.95
In-line Antenna $8.95
All band YAGI with 8-ft. mast can be used in-line or hi-low **$10.74**
WORLD'S BEST DELUXE CONICAL with 8-ft. mast and heavy cast fittings. **$10.74**
100 ft. of twin lead with any TV antenna $2.39
100 ft. of twin lead ... $3.45 1000 ft. ... $32.50
500 ft. rolls $17.45

SPEAKERS

12" Coaxial PM Speakers **$12.95** ea.

A high fidelity compact package with high pass filter attached to frame. 20 watt capacity; 20-17500 cps. response; 8 ohm VC. A REAL BUY!

Very Best Quality—NATIONAL BRANDS—Individually Packed

	10 or more each	Price Each		
3"	$1.14	$1.26	5 x 7	$2.25 ea.
4"	1.55	1.65	6 x 9	$3.25 ea.
5"	1.69	1.79	5" PM with 50L6 o. p. Xformer	$1.99
8"	2.94	3.23		
10"	4.74	5.10		
12"	5.94	6.54		

SPECIAL—6" PM Speakers, big Alnico 5 magnet in lots of 10 ..... each $1.55
Individual 1.67

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No. 47—100 for ONLY . . $3.95
Box of 10 Bulbs . . 45c

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#40 #41 #46 100 Bulbs $5.88
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TV Screen Filters with suction cups—best quality INDIVIDUALLY BOXED for highest re-sale value. 10" ..... $1.48; 12" 2.34

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Standard Replacement Regular size
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Midget 455 Kc ..... ea. 47c
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100 ft. 69c

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Loctal Sockets ..... 10 for 59c

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10BP4	$11.95
12LP4	$19.95
14BP4	$22.95
7JP4	$17.95
16RP4	$29.95
16TP4	$29.95
17BP4A	$31.95
19AP4A	$44.95

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Stock up while they last, all 4-prong Universal Vibrators.

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STANDARD REPLACEMENT

For 50L6, 35L6, 50A5, 35A5, 117L7 ..... **74c** ea.
For 6V6, 6F6, 3Q5, 1Q4, 3S4, 3V4, 41, 42, 6K6, 2A3, 45, 6L6 ..... **79c** ea.

UNIVERSAL OUTPUT TRANSFORMERS SPECIAL
Up to 12 watts to any speaker (while they last) ..... ea. **$1.18**

VOLUME CONTROLS

	10 or more Each	Price Each
VERY BEST BRANDS		
½ meg. or 1 meg. or 1/10 meg. with switch—long shaft	52c	59c
2 meg. for battery sets—switch, long shaft	52c	59c
½ meg., 1 meg., 1/10 meg. or 2 meg., long shaft, less switch	34c	38c
1000 ohm	19c	23c
5000 ohm	19c	23c
½ meg. with 6" shaft	59c	71c

10% deposit with order, balance C.O.D. $1.00 handling charge for orders less than $5.00. All shipments F.O.B. Chicago. Our parts and tubes are warranted to be 100% replacements for the prototypes in the listings above. Prices are subject to revision without notice. Satisfaction Guaranteed. Illinois residents add 2% sales tax. ORDER TODAY!

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Very best brands. Fresh stock

450 Working Volts

8—450 V.	ea. 29c
10—450 V.	ea. 35c
20—450 V.	ea. 47c
30—450 V.	ea. 59c
30—450 V. w/ 20—20—25 V.	ea. 35c
10-10—450 V.	ea. 52c
20-20—450 V.	ea. 59c
10-10-10-20—450V-150-25 V.	ea. 59c
30-30—400 V-350 V.	ea. 47c
30-30-25—400 V-25 V.	ea. 47c

150 Working Volts

8—150 V.	ea. 23c
8-8—150 V.	ea. 23c
10—150 V.	ea. 23c
10-10—150 V.	ea. 29c
10-10-10—150 V.	ea. 35c
15—150 V.	ea. 25c
20—150 V.	ea. 10c
30—150 V.	ea. 35c
40—150 V.	ea. 35c
15-15—150 V.	ea. 35c
20-10—150 V.	ea. 35c
20-20—150 V.	ea. 35c
30-20—150 V.	ea. 47c
30-30—150 V.	ea. 47c
35-35—150 V.	ea. 47c
40-20—150 V.	ea. 47c
40-40—150 V.	ea. 47c
40-40—150 V-25-25 V.	ea. 47c
50-10—150 V.	ea. 47c
20-16-16—350 V. Sprague type	ea. 47c
25-25—150 V-200-10 V.	ea. 47c
15-15-40-20—150 V-25 V.	ea. 35c
20-20—150 V-25 V.	ea. 47c
30-30-200—150 V-10 V.	ea. 47c
20-16-16—150 V.	ea. 47c

Cathode Condensers
10-25 V
20-20—25 V
20-20-20—25 V
30-50 V. } 19c ea.
100—25 V. ..... 23c ea.

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100 Condensers assorted in package **$7.14**

.001	6c	.0005	7c		
.002	6c	.00025			
.003	6c	.0005			
.01	600 V. 8c	500 mmf		600 V. MICA	
.02	8c	250 mmf			
.05	10c	100 mmf			
.1	11c	50 mmf			

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In lots of 25 or more ..... ea. 11c
.25 mfd. 600 V. Less than 25 ..... ea. 14c

400-VOLT BY-PASS CONDENSERS
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.2 mfd. ..... ea. 7c
.25 mfd. ..... ea. 12c
.5 mfd. ..... ea. 18c

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.005 mfd. 1600 WV
.008 mfd. 1600 WV ..... ea. 18c
.01 mfd. 1600 WV

VARIABLE CONDENSERS
Two-gang for superhet or TRF .. ea. 53c

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cations on two of the company's latest test instruments, the Model SG5 square wave generator and the Model MO5 insulation resistance tester.

The square wave generator which is designed for the high speed testing of response characteristics of wideband amplifiers, wideband oscilloscopes, television video amplifiers, etc., has five fixed output frequencies of 50, 1000, 10,000, 100,000, and 500,000 PPS.

The Model MO5 is a compact, portable, battery-operated insulation resistance tester which operates entirely from two self-contained 1½ volt batteries.

For copies of this data sheet write direct to the company specifying Bulletin No. 502.

CIVIL DEFENSE RECEIVER

The Advertising Distribution Section of the *General Electric* Electronics Department, Electronics Park, Syracuse, New York is currently offering copies of a new catalogue sheet which describes the company's new civil defense receiver in some detail.

Designed for application wherever two-way radio systems exist, the new unit is available in two models for low and high band operation.

The new data sheet provides complete specifications and features on the receiver.

The receiver can be used to alert key agencies and personnel in a community-wide civil defense radio communications system and for remotely controlling air raid sirens and other warning devices.

ROBOT CONTROLS

Free literature covering modern operating equipment for doors and gates is being offered to interested persons by *Robot Appliances, Inc.* of 13165 Prospect Avenue, Dearborn, Michigan.

This comprehensive bulletin includes a simple description of such devices along with a liberal use of explanatory diagrams and photographs.

The bulletin describes in some detail the most important applications of such devices both in the home and in commercial establishments, factories, warehouses, and public institutions.

Copies of this bulletin will be forwarded, on request.

—30—

Voice Controlled Unit

(*Continued from page* 57)

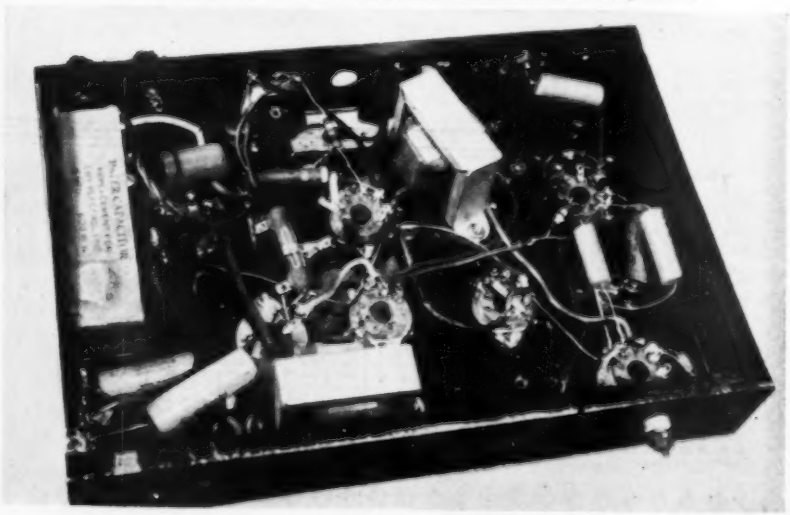
we get the transmitter on, the receiver off, and the antenna switched with one control or *vice versa* on reception.

Just a word of warning. Condenser C_6 must be a paper type as an electrolytic has too much leakage for this application. The power supply for this gadget is not shown on the diagram since any conventional layout which gives 250 volts d.c. at 70 ma. can be used.

In the front view of the unit the power transformer, rectifier tube, filter condenser, and relay are shown at the left of the chassis. The 2050 tube is in the center and the 6SJ7 and 6J5 are to the right of the chassis with the 6H6 located between them and the 2050. The two binding posts for the control circuit are to the left on the front apron with the delay control next and the input connector to the extreme right. Connections are made through an *Amphenol* "Y" connector (not shown in the photograph) one side of which connects to the mike and the other side to the speech amplifier in the transmitter. If desired, two chassis connectors could be used instead. They should be wired in parallel with special attention being given to adequate shielding.

In the underchassis view of the unit, the filter choke is mounted at the rear of the chassis while the audio transformer is towards the front. There is an unused socket in the center of the chassis which is used mainly as a tie point for various leads. —30—

Under chassis view of the unit. See text for identification of components.



Mac's Service Shop
(*Continued from page 66*)

to keep the crystal, when not in use, in some kind of a desiccator. A capped fruit jar about half-filled with calcium chloride or silica gel and having a wire screen platform fastened above the level of the desiccant makes such a device. The cartridge is simply placed on the wire screen when not in use, and the moisture is removed from it and kept out of it by the action of the chemical beneath."

"Looks like we need a cartridge not affected by tropical heat and humidity," Barney observed.

"We've got them. The ceramic and PN types of cartridges are both capable of withstanding high temperatures. The PN cartridge will temporarily take temperatures as high as 212 degrees without permanent injury. Then, too, there are the variable reluctance cartridges. Unfortunately, each of these has one drawback or another, such as low output voltage, nonlinear response, restricted range, or high cost that prevents any one from being the perfect substitute for the old reliable Rochelle salt cartridge."

"I'm a little hazy on just how crystal cartridges are made," Barney confessed. "I intend to save up a bunch of old ones and take them apart some day when business is slack."

"There's no need to do that," Mac said. "I have reprints of several articles that have appeared in technical magazines which give isometric drawings, cross-section views, assembly pictures, etc., of both conventional and lever-type crystal cartridges. These illustrations and the accompanying text will give you a very clear idea of how cartridges are put together and how they work."

"That ought to be enough 'canned' information to hold me for a while," Barney said. "I'll read the stuff tonight. Now have you got any information that you have picked up from your own experience?"

"You probably have most of that already," Mac said. "I have showed you how you can often detect a cracked crystal by applying a slight lateral pressure to the tone arm while it is playing a record. This pressure holds the broken edges firmly together and makes the output sound fairly good until the pressure is released. You have also heard me tell customers time and again to hold *the needle*, rather than the tone arm, with the fingers of the left hand while the needle-holding screw is tightened with the right. This prevents the excessive torque applied to the screw from being transmitted to the crystal itself.

"You also know how insistent I am on using an exact duplicate replacement cartridge when at all possible; and, when this cannot be done, we try to match the needle-pressure, voltage output, and frequency range of the substitute crystal as nearly as possible

to the characteristics of the original. Just because a cartridge will fit mechanically is certainly no sign it is a satisfactory replacement.

"You have also noticed that I often sell and install a complete tone-arm when one of the old-fashioned crystal cartridges goes bad in a really good player. I do this to give the customer the advantages of new type cartridges, which include greatly reduced record wear because of lighter needle pressures and also extended tone range. Putting such a cartridge in one of those heavy old tone arms is no good. Of course, in the cheaper record players, such as those designed for playing children's records, this added expense is not warranted."

"I remember vividly," Barney said with a reminiscent grin, "that we *never* solder leads to cartridge pin-jacks with the jacks in place on the pins. I quote: 'Those jacks are used just to keep the heat of the soldering iron away from the crystal element!' "

"Well, I wanted to make that emphatic," Mac said with an answering grin. "And another point that is equally important is never to move a record player without first seeing to it that the tone arm is firmly fastened with *Scotch* tape or some other similar means so that it cannot flail around inside the cabinet while on the way to or from the shop. Many a cartridge has been taken for a last ride because this item was overlooked." —30—

Converting the Model 811

(*Continued from page* 41)

reconnect it to terminal #8 of the sweep transformer. Make sure the leads from the horizontal size coil do not short to the frame of the sweep transformer. Connections from terminals #4 and #8 of the sweep transformer should be made with high voltage insulation wire. Short out the series coil in the size control by shunting resistor R_{64} with a jumper wire. Terminal #5 on the transformer is not used.

Now remove the 4700 ohm resistor, R_{63}, from across the horizontal linearity control, L_{19}.

Connect the new deflection yoke and focus coil into the circuit using the old components as a wiring guide.

Assemble and connect the 16KP4 picture tube to the chassis and turn the receiver on. Adjust the focus coil and ion trap for brightness and the width, horizontal linearity, height and vertical linearity controls for the most linear test pattern.

The height can be corrected by connecting a resistance box across the 2.2 megohm resistor, R_{28}, which is connected between pin #5 of the 6SN7GT vertical sweep generator (V_9) and the vertical size control. The resistance should then be varied, together with the vertical size and height controls, until a linear pattern is obtained. Either the shunt resistance or total resistance can be measured with an

932 PHOTO TUBE

Gas Phototube having S1 response, particularly sensitive to Red and Near Infrared Radiation. Can be used with incandescent light source. Send for Data. Price **75c**

ARC 5 MODULATOR

MD7/ARC5 Plate Modulator w/ dynamotor complete w Tubes 1—1235, 2—1625, 1—VR50. Good cond. Price....**$6.95**
BC456 Screen Mod. **$2.25**

EE89A TELEPHONE REPEATER

Used to extend range of field telephones, teleg. & 20 cyc. ringing possible over lines complete w/3Q5 tube & phone. Featherweight. Price **$9.95**

Heineman Ckt Bkrs for AC-DC operation.

AM	1510M	7 Amp
	1614	80 Amp
	1614	50 Amp

Price each **$1.10**

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Photo Material Ethyl Phthalate (East Kod) Approx. 1 Qt. Bottle **$5.95**
Oetonit Surface Cleaning Solution Photomat Ribbonat Apx. 1 Qt...**$3.95**
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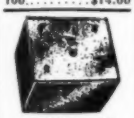
AMPLIFER

AM-32/PRSI less batt w/carry case for Mine Detector AN/PRSI, w/tubes. Price ea. ...**$5.95**

Birtcher Tube Clamps

Many types in stock. Phone or write spec.

Each	.16c
10	$ 1.50
100	$14.00



400 MA 12 HY Choke

90 ohms Herm. sealed. Special **$3.75**

R5/ARN7 Compass Rec ADF Rec 100-1750 Kc. in 4 bands 5 gang Tuning Capacitor w/15 Tubes. Phone for price.

Fish Pole or Sectional Antennas

MS49-50, 6½ ft.	49c
MS49-52, 12½ ft.	$1.69
MS49-53, 18 ft.	2.49
MS49-56, 25 ft.	5.98
BASES: MP22	3.95

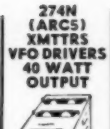
Mfd.	Volt.	Price
5	50	$0.45
650	80	1.95
5	150 AC	1.45
15	220 AC	2.20
1	500	.40
7	600	1.25
20	900	2.10
0.5	750 AC	1.59
0.05	1000	.69
2x0.5	1000	.70
1	1000	.75
1.5	1000	.85
2	1000	.90
4	1000	1.75
3x.01	1200	1.25
0.0016	1500	1.25
1	1500	1.30
1.5	1500	1.40
2	1500	1.45
2x0.1	2000	1.10
1	2000	1.45
2	2000	2.25
3	2200	2.45
0.5	2500	1.35
1.5	2500	1.35
0.15	4000	1.20
2x0.1	4800	1.20
0.1	6000	1.20
2x0.1	7000	1.25
0.1	7500	1.25
2x0.15	8000	4.75

MANY OTHERS

6V Input Dynamotor Output 150V/75MA or 12V Input, 500V/50MA Out. **$3.49**

Avail. in Stock. Dual XMTTR & Dual Rec. Triple Rack Mounts MT63 — MT65 — MT71. Banged Up. Sold As Is. No Refund. Repairable **$1.00**

274N (ARC5) XMTTRS VFO DRIVERS 40 WATT OUTPUT



4-5.3MC $5.95
5.3-7MC $5.95
7-9.1MC 13.95
Used. Good Cond. w/tubes& XTAL

BC 604 DM Transmitter F-M 20-28 MC 11 & 15 Mtr. Can be operated on 10 Mtr. 10 Channel push button control w/tubes meter. Less Xtals. Good used. Includes Dynamotor ...**$15.95**
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RL 9 or RL 7

Interphone Amplifier Converter to High Fidelity Phone Amp. or Spch. Amp. Comp. w/12A6, 12SL7, 2 Chokes. 1XFRMR, DYN for 24v. operation, **$2.29**

BC-746 TUNING UNIT

Plug-in transmitter tuning unit from Army Walkie-Talkie. Contains antenna and tank coils, tuning condenser, transmitting and receiving crystals. Ideal transmitter foundation. Price **$1.29**

GIBSON GIRL

The Emergency Radio Transmitter. Send S O S signals automatically on 500KC. 150-mile range. No batteries required. Has hand-driven generator, tubes, wire. New. It's only.....**$4.29**

1% PRECISION RESISTORS

.6	128	10,000
1.01	250	12,000
3	300	12,000
5.05	430	17,000
10.1	463	17,300
18	800	20,000
43.5	920	25,000
50	1100	30,000
75	4300	33,000
82	5000	40,000
120	7500	55,000
125	8500	57,000
128	10,000	75,000
150	10.000	84,000

20c ea. 10 for $2.50

100,000	150,000
120,000	220K
120,000	250K

40c ea. 10 for $3.50
1 Meg. 75c ea.

CRYSTALS Low Freq.

FT241-A. Holder ½" Pin spacing, for ham and general use. Xtal controlled. Signal Generators, marked in army Mc harmonic frequencies—Directions for deriving fundamental frequencies enclosed. Listed below by fundamental frequency, fractions omitted.

370	396	420	446	487	514	447
372	397	422	458	488	515	448
374	398	423	459	490	516	450
375	400	424	461	491	518	451
376	401	425	462	492	519	453
377	402	427	468	493	520	454
379	403	429	469	494	522	455
380	404	430	470	495	523	456
381	405	431	472	496	525	457
383	406	433	473	497	526	463
384	407	434	474	502	527	465
385	408	435	475	503	529	498
386	409	436	476	504	530	500
387	411	437	477	505	531	501
388	412	438	479	506	533	538
390	413	440	480	507	534	540
391	414	441	481	508	536	
392	415	442	483	509	537	each
393	416	443	484	511	each	
394	418	444	485	512	**69c**	**$1.49**
395	419	445	486	513		

WESTERN ELECTRIC	PRECISION RESISTORS 1%	
D-164886A	2.65 ohms	
D-164886A	3.83 ohms	
D-167026	13,500/10,500 ohms	
D-162025AT	1400/135/270 ohms	
D-164285	40,600/1500 ohms	
D-166860FL	1155 ohms	
D-162707CY	2500 ohms	
D-171862	279 ohms	
D-171863	591 ohms	
D-164286	10,000/15,000/62,000 ohms	
D-164284	100,000/50,000 ohms	
D-172241	400/600/700/750 ohms	

@ 75c ea.

ARC 5 EQUIPMENT

PA Coils No. 7247	79c
Parasitic Suppressors	9c
1 Kit of 3, 2830 KC IFs, consisting of input, intermed, and output for 6-9 Rec	$1.25
No. 6234 RF	65c
BFO Rec 2830 KC for 6-9 MC No. 5856	49c
1415 KC for 3-6 MC No. 5855	49c
Cond 3X.05 300V 5414	5c
Cond .05-.01-.05 300V 5415	10c
XFRMR Mike to Grd No. 6261	79c
OSC Coil No. 6029, 6030, 6032	79c ea.
Plug 6 Pin for IF	10c ea.
Plug 7 Pin for Rec. Chassis	10c
Plug 3 Pin for Rec. Dyn. Male and Female	15c ea.
Plug 3 Pin for Mod. Dyn. Female	15c
Plug 5 Pin Chassis Mnt.	29c
Plug No. 5842 Rear Rec. XMTR Male	39c
Plug No. 5577 6 Pin Rec. Rack	29c
Plug No. 6418 8 Pin Rec. Rack	29c
Plug No. 7027 18 Pin Mod. Chassis	29c
PL 154A 12 PNG Male	49c
PL 153A 18 PNG Male	49c
PL 148 3 PNG Male	49c
PL 156A 5 PNG Male	49c
Plug No. 2674 Chassis High Freq. Rack, 2 PNG	29c
Plate 190-550 Receiver	10c
Plate 190-550 Cont. Box	10c
Load Coils No. 6035, 6034, 7992	59c ea.
Fuse Mtrs. Dual	13c ea.
Crystals	$1.00 ea.
Tubes 1626-1629-1625. Write for Other Equipment.	

SELSYN TESTER

Magnesyn Instrument Field Tester AAF 43G23330 Spec. 40772. To test individual mag. Ind. & Xmitters, for isolating Faults in magnesyn systems. Brand new **$99.00**

LEARN OR TEACH CODE

Uses 6-10-24-115V

DC, 115-230 VAC. Can use hookup of over 20 students. Contains speaker, blinker, freq. control, etc., in fiber trunk 17"x13"x10½". New **$24.95**

VARIABLE TRIMMER CONDENSERS

C830	15	MMF
C881	20	MMF
C993	50	MMF
C677	60	MMF

} 32c ea.

VITREOUS RESISTOR AND OTHERS

Ohms	Size	Type	Price
5M	2x½ D	Lugs	20c
12	2x1⅛ D	Lugs	18c
2500	2x½	Lugs Var.	20c
5M	2x½	Lugs	20c
100	1¼ x½	Lugs	15c
3150	2x½	Lugs	20c
1000	2x½	Leads	20c
500	4½ x⅜	Lugs	30c
7500	4x½	Lugs	30c
10	2½ x¾		35c
3000	3x¾	Lugs	25c
12000	3x¾	Lugs	25c
10	6½ x1⅛	Lugs	45c
5CT	6½ x¾	Lugs	40c
5000	2x⅞	Lugs	20c

BATHTUB CAPACITORS

MFD	VOLT.	TYPE	PRICE EACH	10 FOR
.5	400	2BT	$0.23	$2.20
.5	600	2TT	.25	2.40
3X.1	600	3TT	.45	4.35
3X.1	600	3ST	.45	4.35
2X.1	400	3ST	.26	2.50
2X.1	600	3ST	.28	2.65
2X.1	600	3BT	.28	2.65
2X.1	400	2TT	.26	2.50
2X.1	200	2ST	.23	2.20
2X.1	600	2BT	.26	2.50
2X.1	600	3TT	.26	2.50
.1-.1-.025	400	3ST	.28	2.65
.1	600	2BT	.22	2.10
.1	600	1ST	.22	2.10
.1	600	2TT	.22	2.10
.1	600	2ST	.22	2.10
.13	600	3ST	.25	2.40
2X.25	600	3ST	.30	2.85
.05	600	2TT	.21	2.00
1	100	2TT	.23	2.20
20	50	2ST	.26	2.50

MICA CAPACITORS

SOLAR XMB TAPPED POLES

Mfd.	Price
2500 V Test	
.00001	$0.29
.000025	.29
.00003	.29
.00005	.29
.00075	.29
.0001	.29
.00015	.29
.00025	.29
.0003	.29
.0004	.29
.0005	.35
.00075	.35
.00085	.35
.001	.35
.0015	.35
.0016	.35
.0017	.35
.002	.65
.0023	.65
.003	.75
.004	.95
.005	.95
.006	.98
.0063	.98
.0069	.98
.007	.98
.0075	.98
.0076	.98
.008	1.10
.01	1.10
.015	1.10
.02	1.10
.025	1.10
.027	1.10
.03	1.10
5000 V Test	
.0015	1.75
.002	2.00

Solar XQ Solder Lugs
2500 V Test

.01	.85
.015	.85
.03	.85
.04	.85
.001	.60
.0015	.60
.002	.60
.0022	.60
.0023	.60
.0024	.60
.0025	.60
.0027	.60
.003	.60
.004	.60
.005	.60
.0056	.60
.006	.60
.0063	.60
.0075	.80
.0076	.80
.008	.80
.0082	.80
.0005	.60
.00085	.60
.00015	.60

Write for Many Others. Write for Catalogue of Xfrmrs, Chokes, Cond., Etc.

TOP TRANSFORMER BUYS

These XFRMRS are Army Spec. All Underrated.

Comb. Transformers—115V/50-60 cps input

Item	H.V.	Amp.	Filaments	Price
CT-861	2100VCT	.175	7.5VCT/4A, 2.5V/10A	$10.95
CT-075	265VCT	60 MA	2A/3A, 6.3/6A, 6.3/4.5A	1.95
CT-142	645VCT	.060	5V/2A,6.3V/1.2A	4.25
CT-825	360VCT	.340	6.3VCT/3.6, 6.3VCT/3A	3.95
CT-076	600V	.100	2 x 12.6V/1	1.95
CT-626	1500V	.160	2.5/12, 30/100	9.95
CT-15A	350VCT	.070	6.3/6, 6.3/1.8 3 lbs	2.95
CT-071	15VCT	2.0	33/200, 5V/10, 2.5/12	2.95
CT-378	2300V	4 MA	2.5/2	6.95
CT-367	580VCT	.050	5VCT/3A	2.25
CT-721	550VCT	.100	6.3/1, 2.5VCT/2	2.95
CT-99A	2x110VCT	.010	6.3/1A, 2.5 VCT/7A	3.25
CT-91A	726V	.100	5V/3A, 6.3/3.5	3.25
CT-441	50V	.200	5V/2.4, 5V/1.2	2.25
CT-408	350VCT	.026 MA	5V/3A	2.75
CT-931	585VCT	.086	5V/3A, 6.3V/6A	4.25
CT-610	1250	.002 MA	2.5V/2.1A, 2.5V/1.75A	4.95
CT-137	350VCT	.026 MA	5V/3A	2.75
CT-102	1080VCT	.055	25V/3A,6.3V/1.8A,6.3V/1.2A	5.95
CT-966	330V	.065	6.3V/1.2, 6.3V/600 MA	1.75
CT-319	330VCT	.085	5V/2, 6.3/7.5, 6.3/3	3.25

Filament Transformers—115V/50-60 cps input

Item	Rating	Each
FT-852	23V .35A	$ 1.79
FT-599	78V/.300, 6.3V/2A	1.95
FT-719	1.3V/6A	.79
FT-029	13.5V/1.11A	.79
FT-367	5VCT/3A, 58VCT/40A	1.10
FT-346	5VCT/13/5, 5VCT/6.75, 5VCT/6.75	5.95
FT-781	866 Trans. 2 x 2.5/5A	2.25
FT-511	3.4V/300A, 7½ H x 10" x 5"/2W	14.95
FTG-31	2.5V/2.5, 7V/7A (Tape @ 2.5V/2.5A), 16 lbs.	9.95
FT-674	8.1V/1.5A	1.10
FT-157	4V/16A, 2.5V/1.75A	2.95
FT-391	6.4V/3A	1.10
FT-736	2 x 6.3VCT/3.2-1.2A	1.49
FT-461	2 x 6.3VCT/1A	1.10
FT-899	2 x 5 V/5.5A 2900 Rms	22.95
FT-418	6.3VCT/1A, 6.3VCT/7A	1.95
FT-735	6.3VCT/5A, 6.3VCT/1A	1.79
FT-101	6V/.25A	.79
FT-738	6.3VCT/1A, 5V/2A	1.69
FT-774	6.3V/1.6A	.79

Plate Transformers—115V/50-60 cps input

Item	Rating	Each
PT-976	Auto: 120VCT/10 MA	$ 0.69
PT-31A	2 x 300V/5 MA	.79
PT-46A	4080VCT N.L. 3% to 1.8" H x 6" W x 7" L 20 lbs.	29.95
PT-033	4150V/400 MA 11½ x 9¼ W x 9" D 70 lbs.	49.95
PT-75-2	3780/3446/3112VCT/77 MA	10.95
PT-28-1	4600VCT/.077	12.95
PT-403	Auto: 70V/1A	2.29
PT-160	1120VCT/770 MA, 590VCT/82 MA, 25 lbs.	24.95
PT-170	Auto: 156/146/137/128—.71A	3.29
PT-139	42V/46V/50V/55V/15.2A 7½x7" W x 6¾" H.	10.95
PT-31A	2 x 300V/5 MA	.79
PT-976	120VCT/10 MA	.79
PT-67-1	62V/3.5A	2.95
PT-12A	240VCT/1.2A	2.95
PT-997	78V, .00754 KVA, AUTO	1.49

DYNAMOTORS AT SURPLUS PRICES WRITE OR PHONE

BC434 Control Box. Remote Control for 433 Radio Compass contains 0-5MA Meter Dial Control **$3.95**

PHOTO PRINT DRYERS

Consists of nichrome element insulated from open frame 9¾ x 10" 110V 60 Cy. **75c**

Tinn. Clamps
3 Lock
4 Lock
7 Clamp
18 Clamp
Adel Clamps
6 Clamp
10 Clamp
12 Clamp
WRITE

Screen Mod. XFRMR for pair of 807's PP — PP or Parti Sidetone Wndg. 95c

T. U. for BCAR230 or 430
3.2—4MC
5—6.2MC
1.2—1.5MC
1—2MC
Price 95c ea.
4—5MC w/ 4495KC XTAL **$1.69 ea.**

NEW—BC-906 FREQ. METER—NEW

Range 15-22.5 MC—Bat. operation with precision velvet vernier dial, tuning charts, 0-500 D.C. microammeter, diode - Triode and plug-in antenna. Contained in black aluminum carrying case 12½ x 8¾ x 6½. Price **$15.95.**

COLLINS ART-13 FREQ. MULT UNIT
2-18 Mc for two 1625 Tubes. Comp. Assy. less Tubes & Coils w/ckt dia. Price $8.95

HEADSETS & MIKES

HS23 Used Good 8000 Imp. **$2.49**
HS33 Used Good 600 Imp. **$2.49**
HS30B Replace Elements .....**60c ea.**
Rubber Earplugs for HS30 .....10 for **25c**
Matching XFRMR C410 Less Cords **99c**
T45 Lip Mikes **98c**
T30 Throat Mike **39c**
CD508T30 Ext. Cords w/ Switch Sw141. Complete **$1.25**
Carb Mask Mike Elements **49c**
Cords 3 Cond. Color coded approx. 42" .....**15c ea.**
Hdband HBI **25c**
Hdband HB30 .....**25c**

Tuning Units for BC375 & 191 Diag. for Conver to VHF Freq. Meter in Oct., 1950.

TU7	4500—	6200KC.
TU8	6200—	7700KC.
TU9	7700—10000KC.	
TU20	200—	500KC.

Price **$2.49 ea.**

BC 605 INTERPHONE AMPLIFIER

Easily converted to an ideal intercommunications set for office—home — or factory. Complete w/conversion diagram for 110V operation. **$4.49**
Brand New **$3.95**
Used **$3.95**

Aircraft Rec. 429 for Mobile or Aircraft Covers from 201 Kc up by interchange plug in tuning units Includes one Dual Tuning Unit: 200 KC. 400 KC. & 2.5 Mc-4.7 Mc. Less tubes. Rec. Only a few left. .....**$3.95 ea.**

0-4 Amp RF GE Type DW52. 2% Accuracy Expanded Scale. 2.19" dia. Int. Thermocouple. List Price $19.75. Our Price **$3.95.**

ANTENNA MAST

Are you in a dead spot? If you can't get a good T.V. Picture here is a sig. Corp. Ant. mast 30' high of rugged plywood construction to solve your problem. It telescopes into 3 ten ft. sect. for easy stowage. Easy to Mnt. Comp. with stakes & rods. **$19.95**
Each. .....

SOLENOID

24 Volt DC GE CR9536K 100A2 w/2 DPDT Switchettes **$2.95**

MC 131 Pressed Metal Ringers 2-5/16 Dia. Used on 115v 60 Cp P/o EE8...**$1.25 each**

PORTABLE CASES

Reg. Size Record Player Case. CASE: 3/8" Plywood Construction 10⅞" x 7" Sq. Cut out for Speaker Door 13" x 15" x 2¾". Opens on Top. W2 Hasp Locks on Side & Carrying Handle.
Dimensions: 20½" x 15" x 8¾".
Covering: Wine or Blue Thin Leatherette.
Hardware: Large Non Rattle Carrying Handle, w/4 Metal Dome Feet. New.
PRICE **$2.75**

Reg. Traveling Radio Case. Case: ⅜" Plywood Construction w/shelve inside back-open. Less Front panel 5⅜" x 11¾".
Dimensions: 10" x 13⅜" x 6¼". Covering: Brown Blue or Red Leatherette Covering.
Hardware: Large Non Rattling carrying Handle w/4 Metal dome Feet.
PRICE **$2.00**

Small Size Record Player Case. Case: ⅜" Plywood Construction.
Dimensions: 10⅛" x 12⅜" x 5½".
Covering: Red & Blue Leatherette.
Hardware: Large Bakelite Handle w/4 Metal Dome Feet.
PRICE **$2.50**

All merch. guar. Mail orders promptly filled. All prices F.O.B. N. Y. C. Send MO or Chk. Only shipping chgs. sent C.O.D. Rated Concerns send P.O.

COMMUNICATIONS EQUIPMENT CO.
131 Liberty St., New York, N. Y. Dept. N-5 Chas. Rosen Phone: Digby 9-4124

MIN. ORDER $3.00

ohmmeter and the required change made. It was found necessary to reduce the value of this resistor to 1.3 megohms in this particular receiver, however, this resistance may vary somewhat in different receivers.

Cabinet Changes

To adapt the cabinet of the Model 811 to accommodate the 12 inch tube first remove the mask and safety glass assembly which is held in by several wood screws accessible from the inside of the cabinet. If a 12LP4A picture tube is to be used, the wooden panel in back of the safety glass can be angle-cut with a jig saw to make a 12 inch "expanded" mask. A template can be made according to the dimensions given in Fig. 3. This should be centered on the panel as the original opening was above center. The angle cut should be approximately the same as the original mask. The four angle brackets can be relocated so that the springs on the "grounding" ring will hold the 12LP4A in place. The front of this panel should be painted with a paint similar to that originally used. It was found that "Sunlit Green" in the *Dutch Boy* "Wonsover" brand paint was a very close match.

The brown paint backing between the mask opening and the inside bronze border on the safety glass must be removed. A razor blade or some other sharp instrument can be used for this purpose. The wooden block which holds the deflection yoke will have to be moved about one and a half inches toward the back of the cabinet. This is held by two wood screws and glue and can be removed by using a wood chisel to loosen the edges and then tapping with a hammer after the screws are removed. The complete receiver can now be reassembled and the twelve inch conversion is completed.

Sixteen-Inch Cabinet Changes

In making the necessary cabinet changes the safety glass and wooden panel were removed and discarded. Due to the slight difference between the 16KP4 and the 17BP4A faceplate, as shown in Fig. 4, either type tube or mask can be used. A 16 inch mask measuring 13½"x17" outside diameter was used. This mask filled the vertical opening completely and came within ¼" on each side. The mask used was manufactured by the *Tele-Plastics Co.* and can be obtained through local radio parts distributors. The name of a distributor in your locality can be obtained by writing the *Tele-Plastics Co.*, Division of *Willmax Mfg. Co.*, 177 South 8th Street, Brooklyn 11, New York.

Two pieces of wood, 13"x1"x¾" were cut to fill the side openings and hold the mask in place. These pieces were sanded and stained a dark walnut. Two ½" holes were drilled through the side of each piece about two inches from the top and bottom and mounted to each side of the cabinet in back of the mask, using 1¼" wood screws. Two 2" angles were fas-

tened to the cabinet below the picture tube. A piece of ½" rubber cushion was attached to the top surface which provided a "shock" mount and held the picture tube in the correct horizontal position. The "grounding" ring was used to hold the tube to the cabinet by using only two of the four springs. The mounting block for the deflection yoke assembly was moved back about one and one-half inches as described in the 12" conversion. The completed receiver was reassembled and appears as shown in Fig. 2.

Just one word of caution to technicians who decided to undertake conversion work. Always check the complete receiver to make sure it is operating satisfactorily before disassembling. The reasons for this are obvious and it may save call-backs and considerable time when checking the receiver after the conversion has been made. The instructions included herewith are intended to convert the set, not correct circuit faults existing in the set before conversion!

-30-

ATLANTA HAMFEST

THE 1951 Annual Hamfest of the Atlanta Radio Club has been scheduled for Sunday, June 10th at Robinson's Tropical Gardens in Atlanta.

An elaborate program featuring entertainment for every member of the family has been planned. Dinner will be served buffet style with seating for 800 being guaranteed.

Tickets for the affair are $2.50 for adults, $1.75 for children between 4 and 12 with children under 4 admitted free. A drawing for door prizes will be held.

Complete details on the Hamfest and tickets are available from Lee Connell, W4NQO, secretary of the club, 624 Page Avenue, N.E., Atlanta, Georgia.

-30-

AVOID TUBE DAMAGE

By H. LEEPER

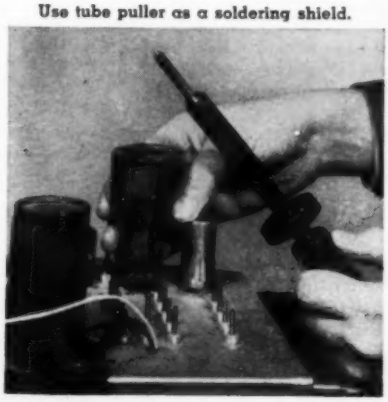
RUBBER tube pullers are available for miniature and other tubes located in confined places.

When using a soldering iron or other tools near one of these tubes, why not cover it with a tube puller as shown?

The tube tip or glass envelope may be saved from damage by so doing.

-30-

Use tube puller as a soldering shield.



RADIO-TV Service Industry News

AS REPORTED BY THE

TELEVISION TECHNICIANS LECTURE BUREAU

A. C. W. SAUNDERS, educational director of the Lecture Bureau and one of the industry's most popular lecturers on practical servicing of radio and television receivers, will deliver the major talks on servicing in May at the annual Town Meeting programs for radio and television technicians which are being sponsored by the Radio Manufacturers Association of Canada.

This year, two series of meetings for technicians have been scheduled by the service committee of the Radio Manufacturers Association of Canada. These are to run concurrently with the first program scheduled for Toronto on May 14, 15 and 16, and the second in Montreal on May 15, 16 and 17. Mr. Saunders will deliver lectures in both cities by means of arrangements the committee has made to dovetail his schedule.

This is the third consecutive year that Mr. Saunders has been invited to lecture at their annual meetings by our good neighbors on the north. His current lecture on the Bureau's program, "20 Basic Points for Television Receiver Service," which has been so very popular with the technicians who have heard it, will be one of the lectures he will present at the Canadian meetings.

Another National Federation Formed

The National Electronic Technicians & Service Dealers Association (NETSDA) was formed recently at a meeting in Washington, D. C., by delegates from twenty-two technician and servicing dealers associations.

The announced aims of this new organization are: (1) The furtherance and improvement of the electronic servicing industry; (2) To promote the welfare of servicing dealers and technicians; (3) To promote a better understanding between the electronic service industry and other major elements of the electronics industry; (4) To promote and secure better relations with the public; (5) To provide educational facilities for its members; (6) To raise the standards of the electronic servicing profession; (7) To cooperate with federal, state, and municipal agencies.

Deviating from the stand formerly held by some associations in the new organization, the delegates voted to accept recognized television contracting and radio service associations as members without regard to the existence of state or regional federations in the areas where they operate.

Temporary officers selected by the delegates are Max Leibowitz of New York City, president; Norman R. Selinger of Washington, D. C., vice-president; Richard R. Devaney of Philadelphia, Pa., corresponding secretary; Roger K. Haines of Haddonfield, N. J., recording secretary; and Vance E. Beachley of Harrisburg, Pa., treasurer.

The address of NETSDA is Dorchester House, 1625 Kalorama Road, NW, Washington, D. C.

Price-Wage Freeze

The television service contractor and the radio service dealer who has not maintained an accurate "breakdown" of his sales of service and parts may find himself in hot water if he doesn't establish these records of past activity immediately. Last March 1st (1951) was the "deadline" for having such records prepared. Permissible charges for both labor and parts are tied to the charges that were made for labor and for parts during the selected "base period." This base period was selected as the period between December 19, 1950 and January 25, 1951.

According to current interpretation of the regulations issued by the Office of Economic Stabilization, the service dealers must keep the following records:

1. Those records which he had on January 26, 1951 that show prices charged for goods and services during the base period. Also the records that show the latest net costs up to that date for parts and supplies which he purchased.

2. A statement of the categories of parts and supplies and a list of the services that he sold.

3. A statement showing the ceiling price for each of the services which he delivered or had available for delivery during the base period together with an identification of each.

4. If the dealer offered his customers the same services at different prices, he must maintain a record of these variations.

1000 KC crystal BT cut	$3.95
3" scope shield	1.29
2 speed dial drive for ¼" shaft ratios 5:1 1 to 1	.39
ATC 100 mmfd air trimmer screwdriver shaft	.29
Centralab 850 S 50MMF 5KV BUTTON COND	.39
500 watt 12.5 ohm power rheostat	3.49

R·H·S

SPECIALS OF THE MONTH

6v, 12v vibrators any type	$ .98
Rotary switch Mycalex, 2 deck SP3T	.39
1 mfd 5000v oil condenser	2.98
2 mfd 3000v oil condenser	3.25
3 mfd 4000v oil condenser	3.95
24 mfd 1500v DC 3KV flash. Excellent for speed lamp	3.95

TUBES!! BRAND NEW! STANDARD BRANDS! NO SECONDS! COMPARE! TUBES!!

Tube	Price
OA3/VR75	$1.69
OB3/VR90	1.29
OC3/VR105	1.49
OD3/VR150	1.29
1B22	3.45
1B23	12.50
1B24	6.95
1B26	3.95
1B27	24.50
1B29	2.75
1B32	8.95
1B36	24.96
1B38	32.50
1N21 Xtal	1.25
1N21A Xtal	2.25
1N21B Xtal	3.25
1N22 Xtal.	1.35
1N23 Xtal.	2.25
1N23A Xtal	3.25
1N23B Xtal	4.95
1N27	1.69
1N34	1.40
1N34A	1.40
1P23	3.95
1P24	1.79
1P36	2.95
1S21	6.95
2AP1	5.95
2AP5	6.95
2C21/RK33	.69
2C22/7193	.49
2C26A	.49
2C34/RK34	.89
2C39	24.50
2C40	4.95
2C43	14.95
2C44	1.49
2C46	7.50
2C51	5.75
2D21	1.79
2E22	1.95
2E24	4.89
2E26	3.69
2E30	2.29
2J21A	9.95
2J22	8.45
2J26	29.50
2J27	29.50
2J30	39.50
2J31	39.50
2J32	39.50
2J33	39.50
2J34	39.50
2J36	97.50
2J37	12.75
2J38	12.75
2J39	39.50
2J40	39.50
2J46	39.50
2J48	29.50
2J49	39.50
2J50	22.50
2J54B	39.50
2J55	97.50
2J61	49.50
2J62	49.50
2K25/723AB	24.95
2K28	39.50
2K29	24.50
3AP1	9.95
3B22/ELIC	2.95
3B23/RK22	4.85
3B24	5.95
3B24W	7.95
3B25	4.65
3B26	3.95
3B27	3.95
3B28	8.95
3BP1	8.95
3C22	64.50
3C23	$9.95
3C24/24G	2.25
3C30	2.95
3C31/C1B	3.49
3C45	12.75
3CP1	2.25
3CP1-S1	2.95
3DP1	4.95
3DP1A	6.95
3DP1-S2A.	8.95
3D21A	1.98
3E29	14.95
3EP1	5.95
3FP7	3.95
3GP1	4.75
3HP7	3.95
4-65A	14.21
4-125A	26.95
4-250A	29.95
4AP10	4.95
4B22/EL5B	9.95
4B24/EL3C	7.95
4B25/6CF	6.95
4B26/2000	8.95
4B28	4.95
4B32	9.95
4C27/CV92	49.50
4C35	29.50
4D22	12.95
4D32	14.95
4E27/257B	17.95
5AP1	3.69
5AP4	3.69
5BP1	5.95
5BP4	5.95
5CP1	4.95
5CP7	4.95
5C22	49.55
5D21	24.50
5FP7	1.95
5GP1	4.95
5JP1	24.45
5JP4	24.45
5J23	12.95
5J29	12.95
5J30	49.50
5J32	99.50
5LP1	13.95
5NP1	5.95
6AS6	3.69
6C21	22.50
6F4	5.95
6J4	5.95
7BP7	8.95
9GP7	14.95
9JP1	14.95
9LP1	19.95
9LP7	14.95
10BP4	18.95
7DP4	17.95
10	.49
12DP7	16.95
12GP7	16.95
12HP7	16.95
12LP4	22.50
15E	1.19
15R	.89
16AP4	42.50
16CP4	42.50
19T8	1.29
23D4	.45
28D7	.98
30 Special	.59
35TG	4.95
45 Special	.39
53A	5.95
75TL	6.95
100R	.89
100TH	9.95
121A	2.98
203A	8.95
204A	$69.50
211	.69
212E	49.50
215A	.19
217C	8.95
227A/5C27	5.95
249C	3.95
250R	12.95
250TH	21.50
250TL	21.50
274A	5.50
274B	2.65
276A	9.95
293A	2.98
294A	5.75
300B	9.95
304TH	27.50
304TL	29.95
305A	34.95
307A/RK75	5.95
310A	8.95
316A	.65
323A/B	24.50
327A/5C37	4.95
328A	13.95
331A	12.95
350A	8.95
350B	2.95
368AS	7.95
371A	1.49
371B	.98
388A	2.75
393A	6.95
394A	4.95
417A	12.95
434A	4.95
446A	4.95
446B	1.79
450TH	47.50
450TL	44.50
527	12.75
559	1.39
562	97.50
575A	13.95
701A	5.95
702A	3.95
703A	7.95
704A	1.05
705A	.89
706BY	39.50
706CY	39.50
706FY	42.50
706GY	42.50
707B	17.95
708A	4.95
709A	3.95
710A/8011	1.75
713A	1.45
714AY	6.95
715A	7.95
715B	12.95
715C	24.50
717A	1.69
721A	2.59
722A	2.95
723A	9.95
723A/B	14.95
724B	3.89
725A	7.95
726A	6.95
726B	29.50
726C	49.50
730A	12.95
750TL	79.50
800	1.95
801A	.49
802	4.49
803	4.49
804	9.95
805	4.49
806	29.95
807	1.98
808	4.49
809	$2.45
810	9.95
811	2.95
812	2.95
812H	6.90
813	8.95
814	3.95
815	2.95
816	1.19
826	.98
828	12.75
829	12.95
829B	14.95
830B	3.95
832	5.95
832A	8.95
833A	37.50
836A	3.95
837	1.69
838	2.95
841	.45
843	.39
845	4.95
849	29.50
851	69.50
852	29.50
860	6.95
861	29.50
864	.39
865	1.45
866A	1.39
866JR	1.29
869B	39.50
872A	2.49
874	1.49
876	.59
878	2.25
884	1.49
885	1.49
902	8.95
905	3.59
908	7.95
918	1.69
919	2.79
922	.98
923	1.05
927	1.59
930	1.05
931A	4.95
954	.39
955	.45
956	.45
957	.45
958	.45
959	.65
991/NE16.	.39
1603	3.25
1613	1.25
1614	1.95
1616	.98
1619	.29
1622	1.98
1624	1.98
1625	.45
1626	.35
1629	.25
1630	.98
1631	1.29
1632	.79
1633	.75
1634	.75
1636	3.25
1638	.65
1644	.98
1654	2.39
1665	1.45
1851	1.89
1960	.79
1961	4.99
2050	1.25
2051	.65
8005	5.95
8011	1.75
8012	$3.95
8013	2.95
8014	29.95
8020	1.29
8025	5.95
9001	2.25
9002	1.49
9003	1.49
9004	.45
9005	2.35
9006	.29
C1JA	9.95
C5B	9.95
C6A	7.95
C6J	6.95
C100D	1.49
CK502AX.	2.95
CK503AX.	2.95
CK505AX.	2.25
CK506AX.	2.25
CK507AX.	2.25
CK512AX.	2.25
CK517AX.	8.45
CK1005	.89
CK1006	.95
E1148	.35
EF50	.69
F123A	8.75
F127A	22.50
F128A	89.50
F606	37.60
F660	79.50
FG17	3.95
FG27A	8.75
FG32	7.95
FG57	14.95
FG81A	3.95
FG105	8.95
FG172	29.50
FG146	8.95
FG434A	4.95
FG451	.89
FG502A	1.85
GL562	97.50
GL592	14.95
HF125	14.95
HF300	19.95
HY114B	.79
HY115	.79
HY615	.29
KC4	37.50
KU610	6.95
ML101	69.50
REL21	3.25
RK20	9.95
RK25	4.49
RK33	.69
RK34	.89
RK48A	4.49
RK59	1.49
RK60/1641	.98
RK65	24.50
RK72	.59
RK73	.59
RX21A	2.95
RX120	8.95
V70D	6.95
VR78	.69
VR91	1.49
VR92	.98
VT127A	3.95
VT158	14.95
VU29	2.95
VU111	1.49
WL468	12.95
WL530	12.75
WL531	12.75
WL532	2.95
WL578	1.29
WL616	37.50
WL619	18.95
WL677	34.50
WL681	22.50

OA2, OA4G, OB2, OZ4, 01A, 1A3, 1A4P, 1A5GT, 1A6, 1A7GT, 1AB5, 1B3/8016, 1B4, 1B5/25S, 1B7GT, 1C5GT, 1C6, 1C7G, 1D5GP, 1D7G, 1D8GT, 1E5GT, 1E7G, 1F4, 1F5G, 1G4GT, 1G6GT, 1H4G, 1H5GT, 1H6GT, 1J6GT, 1L4, 1LA4, 1LA6, 1LB4, 1LC5, 1LC6, 1LD5, 1LE3, 1LG5, 1LH4, 1LN5, 1N5GT, 1P5GT, 1Q5GT, 1R4, 1R5, 1S4, 1S5, 1T4, 1T5GT, 1U4, 1V, 2A3, 2A4G, 2A5, 2A6, 2A7, 2B7, 2V3G, 2X2, 2X2A, 3A4, 3A5, 3A8, 3B7/1291, 3D6/1299, 3LF4, 3Q4, 3Q5GT, 3S4, 3V4, 5R4GY, 5T4, 5U4G, 5V4G, 5W4, 5X4G, 5Y3GT, 5Y4G, 5Z3

DUE TO CURRENT NATIONAL EMERGENCY AND THE CRITICAL RECEIVING TUBE SHORTAGE, TUBES WILL BE SHIPPED AT PREVAILING PRICES. WE WILL QUOTE ON LARGE OR SMALL QUANTITIES.

5Z4, 6A3, 6A4LA, 6A6, 6A7, 6A8, 6AB7, 6AC5GT, 6AC7, 6AD7G, 6AE6G, 6AF6G, 6AG5, 6AG7, 6AH6, 6AJ5, 6AK5, 6AK6, 6AL5, 6AQ5, 6AQ6, 6AR5, 6AT6, 6AU6, 6AV6, 6B4G, 6B6G, 6B7, 6B8G, 6BA6, 6BE6, 6BF6, 6BG6G, 6BH6, 6BJ6, 6C4, 6C5, 6C6, 6C8G, 6D6, 6D8G, 6E5, 6F5, 6F6, 6F6GT, 6F7, 6F8G, 6G6G, 6H6, 6H6GT, 6J5, 6J5GT, 6J6, 6J7, 6J7GT, 6K5GT, 6K6GT, 6K7, 6K8, 6L5G, 6L6, 6L6G, 6L6GA, 6L7, 6L7G, 6N7, 6Q7, 6R7, 6S7G, 6S8GT, 6SA7, 6SC7, 6SD7GT, 6SF5, 6SF5GT, 6SF7, 6SG7, 6SH7, 6SJ7, 6SK7, 6SL7GT

DUE TO CURRENT NATIONAL EMERGENCY AND THE CRITICAL RECEIVING TUBE SHORTAGE, TUBES WILL BE SHIPPED AT PREVAILING PRICES. WE WILL QUOTE ON LARGE OR SMALL QUANTITIES.

6SN7GT, 6SQ7, 6SR7GT, 6SS7, 6ST7, 6SU7GTY, 6SV7, 6T7G, 6T8, 6U5G, 6U6GT, 6U7G, 6V6, 6V6GT, 6W4, 6W7G, 6X4, 6X5GT, 6Y6G, 6Y7G, 6Z7G, 6ZY5G, 7A4/XXL, 7A5, 7A6, 7A7, 7A8, 7AG7, 7B4, 7B5, 7B6, 7B7, 7C4, 7C5, 7C6, 7C7, 7E5, 7E6, 7E7, 7F7, 7H7, 7K7, 7L7, 7N7, 7Q7, 7R7, 7S7, 7V7, 7W7, 7X7, 7Y4, 7Z4, 12A, 12A6, 12A7, 12A8GT, 12AH7GT, 12AL5, 12AT6, 12AT7, 12AU6, 12AU7, 12AV6, 12BA6, 12BE6, 12C8, 12F5GT, 12H6, 12J5GT, 12J7GT, 12K7GT, 12K8, 12Q7, 12SA7GT, 12SC7, 12SF5, 12SF7, 12SG7, 12SH7

DUE TO CURRENT NATIONAL EMERGENCY AND THE CRITICAL RECEIVING TUBE SHORTAGE, TUBES WILL BE SHIPPED AT PREVAILING PRICES. WE WILL QUOTE ON LARGE OR SMALL QUANTITIES.

12SJ7, 12SK7, 12SL7, 12SN7, 12SQ7, 12SR7, 12Z3, 14A4, 14A7, 14B6, 14F7, 14F8, 14H7, 14J7, 14N7, 14Q7, 14R7, 19, 24A, 25L6GT, 25Z5, 25Z6GT, 26, 27, 28D7, 30, 31, 32, 32L7GT, 33, 34, 35/51, 35A5, 35B5, 35C5, 35L6GT, 35W4, 35Y4, 35Z3, 35Z4, 35Z5, 36, 37, 38, 39/44, 41, 42, 43, 45, 45Z3, 45Z5, 46, 47, 48, 49, 50A5, 50B5, 50C5, 50L6GT, 50Y6, 53, 56, 57, 58, 59, 70L7, 71A, 75, 76, 77, 78, 80, 82, 83, 83V, 84/6Z4, 85, 89Y, 117L7/M7, 117N7, 117P7, 117Z3, 117Z6

DUE TO CURRENT NATIONAL EMERGENCY AND THE CRITICAL RECEIVING TUBE SHORTAGE, TUBES WILL BE SHIPPED AT PREVAILING PRICES. WE WILL QUOTE ON LARGE OR SMALL QUANTITIES.

FULL-WAVE SELENIUM RECTIFIER STACKS
Voltage and Current Ratings Based on 35° C. Ambient, Self-Cooled

Max. A.C. Input Volts RMS	Max. D.C. Volts Output	Cell Size in Inches	Max. D.C. Amps. Output Continuous	Order by This Number	Price
SINGLE PHASE BRIDGE					
0-18	0-14.5	1¾" x1¾"	1.3	18B4D1S1	$ 2.95
"	"	2-3/16" x2-3/16"	2.4	18B4E1S1	3.95
"	"	3⅜" x3⅜"	6.6	18B4F1S1	5.45
"	"	4½" x5"	13.0	18B4K1S1	9.50
"	"	5" x6"	17.5	18B4J1S1	12.45
"	"	4½" x5"	26.0	18B4K1S2	18.65
"	"	4½" x5"	39.0	18B4K1S3	25.95
"	"	4½" x5"	52.0	18B4J1S3	31.50
"	"	4½" x5"	70.0	18B4J1S4	37.50
0-40	0-34	1¾" x1¾"	0.60	40B4D1S1	3.45
"	"	2-3/16" x2-3/16"	1.2	40B4EW1S1	4.45
"	"	3⅜" x3⅜"	3.2	40B4FW1S1	5.75
"	"	4½" x5"	6.0	40B4K1S1	10.50
"	"	5" x6"	9.0	40B4JW1S1	13.95
"	"	4½" x5"	12.0	40B4K1S2	19.89
"	"	5" x6"	18.0	40B4JW1S2	23.75
"	"	4½" x5"	25.0	40B4J1S3	33.95
"	"	4½" x5"	34.0	40B4J1S4	36.45
"	"	5" x6"	36.0	40B4JW1S4	41.95
0-120	0-100	1¾" x1¾"	0.60	40B4D3S1	8.45
"	"	2-3/16" x2-3/16"	1.2	40B4EW3S1	11.55
"	"	3⅜" x3⅜"	3.2	40B4FW3S1	17.95
"	"	4½" x5"	6.0	40B4K3S1	25.95
"	"	5" x6"	9.0	40B4JW3S1	34.25
CENTER-TAP					
10-0-10	0-8	1¾" x1¾"	1.2	20C2D1S1	$ 2.25
"	"	2-3/16" x2-3/16"	2.4	20C2EW1S1	2.95
"	"	3⅜" x3⅜"	6.4	20C2FW1S1	4.55
"	"	4½" x5"	12.0	20C2K1S1	5.89
"	"	5" x6"	16.0	20C2J1S1	8.45
"	"	4½" x5"	24.0	20C2K1S2	11.69
"	"	4½" x5"	36.0	20C2K1S3	15.25
"	"	4½" x5"	48.0	20C2J1S3	18.10
"	"	4½" x5"	64.0	20C2J1S4	21.49
"	"	4½" x5"	80.0	20C2J1S5	26.50
"	"	4½" x5"	84.0	20C2KW1S7	29.95
"	"	5" x6"	96.0	20C2J1S6	34.95
"	"	4½" x5"	128.0	20C2J1S8	45.50
3 PHASE BRIDGE					
0-120	0-150	1¾" x1¾"	0.90	40B6D3S1	$14.95
"	"	2-3/16" x2-3/16"	1.8	40B6EW3S1	16.65
"	"	3⅜" x3⅜"	4.75	40B6FW3S1	24.95
"	"	4½" x5"	9.0	40B6K3S1	42.50
"	"	5" x6"	12.5	40B6J3S1	48.89
0-240	0-300	1¾" x1¾"	0.90	40B6D6S1	$27.95
"	"	2-3/16" x2-3/16"	1.8	40B6EW6S1	31.50
"	"	3⅜" x3⅜"	4.75	40B6FW6S1	47.75
"	"	4½" x5"	9.0	40B6K6S1	85.95
"	"	5" x6"	12.5	40B6J6S1	97.25

Note: All Current Ratings Can Be Increased 2 to 2½ Times Normal Ratings by Fan Cooling. When Moisture and Fungus Proof is Desired Add Letter "M" to Last Number of Code

TRANSFORMERS—115V 60 CY
HI-VOLTAGE INSULATION

2700v @ 2 MA; 6.3v @ .6A; 2.5v @ 1.75A	$ 4.45
2500v @ 15 MA	3.49
1540v @ 5 MA; 340-0-340 @ 300 MA	4.35
925v @ 10 MA; 525-0-525v @ 60 MA; 2X5v @ 3A; 6.3v @ 3.6A; 6.3v @ 2A; 6.3v @ 1A	4.85
500-0-500v @ 175 MA	4.55
425-0-425v @ 75 MA; 6.3v @ 1.5A; 5v @ 3A	3.65
415-0-415v @ 60 MA; 5v CT @ 2A; 115/230 Dual Pri	4.25
400-315-0-100-315v @ 200 MA; 2x6.3v @ 9A; 5v @ 3A; 2.5v @ 2A	5.35
500-385-0-385v @ 200 MA; 3x6.3v @ 6A; 5v @ 3A; 2.5v @ 2A	4.75
375-0-375 @ 175 MA, 5v @ 3A, 6.3v @ 5A, 78 v @ 1A	3.79
350-0-350v @ 35 MA	2.49
325-0-325v @ 12 MA; 255-0-255v @ 240 MA.	4.25
300-0-300v @ 65 MA; 6.3v @ 2.5A; 6.3v @ 1A; 2x5v @ 2A	3.25
80-0-80v @ 225 MA; 5v @ 2A; 5v @ 4A	2.97
0-17.4/21.6/25.8v @ 400 MA; 6.4v @ .5A; 2.6v CT @ 2.5A Pri 115/230	3.85
12.6v CT @ 10A; 11v CT @ 6.5A	6.35
3x10.3v CT @ 7A..$6.95 6.3v @ 1A	.98
6.5v @ 12A; 6.3v @ 2A; 115v @ .1A	3.50
6.5v @ 8A; 6.5v @ 6A; 2.5v @ 1.75A	4.17
6.3v @ 1A; 2.5v @ 2A..$2.29 4-0-4v @ 1A	.87
6.3v CT @ 3.5A; 2x2.5v CT @ 3A	2.97
5v CT @ 20A; 10 KV INS	8.95
.6v @ 15A RMS	1.47

TRANSFORMERS—220v 60 Cyc

512.5-0-512.5 @ 427 MA	$ 5.35
3x5v @ 6A; 4v @ .25A	2.95
3x6.3v CT @ 3A; 6.3v CT @ 1.6A	2.95
10v CT @ 6.5A; 6.3v CT @ 2.5A; 6.3v CT @ 1.8A 220/440 Pri	3.95
Step Up/Down 110/220, 500 watt	10.95

EQUIPMENT SPECIALS

ATR Inverter 12v DC in 110v AC Out 125 w Int. 100 w Cont.	New	$14.95
AN/CRW-2 UHF Receiver Less Tubes	New	5.95
BC433 Receiver	Good	24.94
BC456 Modulator	Good	1.98
BC434A Control Box/BC433	Used	1.95
BC459 Transmitter	Good	10.95
BC778 Gibson Girl	Good	3.98
BC950A-121 Xmitter 100-156 MC	New	69.50
BC1016 Tape Recorder	New	459.50
BC1206B Beacon Receiver, Less Tubes	Good	3.95
CF1 Navy Unit w/200KC Crystal	New	14.95
DM 19 Dynamotor 12v DC in 500v 200 MA Cont. Output	Good	6.95
MN26C Compass Receiver	Good	24.95
M110 Dynamic Chest Mike	New	3.95
PE94 Dynamotor/SCR522	Good	1.98
PE97A Vibrator Power Supply	New	6.95
PE103 Dynamotor	Like New	29.95
R89/ARN5 Receiver Less Tubes, Covers	Good	14.95
SCR518 Altimeter Complete	New	97.50
T17 Carbon Mike	Used	1.59

FILTER CHOKES HI V INS

.025 HY @ 1.36A	$1.98
2 HY @ 175 MA.	1.49
3 HY @ 50 MA.	.39
5 HY @ 1A.	13.95
5 HY @ 70 MA/.2 HY 350 MA Dual	2.39
10 HY @ 700 MA.	11.95
10 HY @ 55 MA.	.89
10 HY @ 100 MA.	1.49
10 HY @ 250 MA.	$3.15
10/20 HY @ 85 MA	1.49
13 HY @ 130 MA.	1.55
15 HY @ 25 MA.	.59
200 HY @ 10 MA.	2.95
325 HY @ 2 MA.	2.95
600 HY @ 1 MA.	2.95

RADIO HAM SHACK Inc.
189 GREENWICH STREET . NEW YORK, N. Y.

PHONE DIGBY 9-0347

WRITE FOR QUANTITY PRICES

Prices subject to change without notice. F.O.B. NYC, minimum order $10.00. 20% deposit required. All merchandise guaranteed.

And the regulations require that the following current records must be maintained by the service dealer:

1. A record of the prices which he charged for his services.
2. The necessary records to establish the basis for his ceiling prices under the regulation.
3. Purchase invoices for parts and supplies on which he should record his initial selling prices and the section of the regulation under which he has determined his ceiling price.

Critical Materials Conservation

The recent announcement by *RCA* detailing the accomplishments of its engineering research program in conserving critical materials underlines a number of changes that will be showing up in the parts and equipment used by the service industry. Outstanding among the engineering accomplishments described in the report are the development of a new electrostatic-focus television picture tube and the radical redesign of loudspeakers used in both radio and television receivers.

It is said that the performance of *RCA's* new electrostatic kinescope is fully comparable with the performance standards of the electromagnetically-focused tubes now in use and that electrostatic focus is readily adaptable to all sizes of television picture tubes.

There was a substantial saving in the use of critical materials effected by the *RCA Service Company*, according to the report. An estimated saving of 50% in aluminum used for antenna masts during the first quarter of 1951 was accomplished through the use of smaller tubing and stronger alloys which permitted a reduction in wall thickness of the aluminum tubing used. The measures now in effect have reduced the consumption of copper in transmission lines by as much as 33% with tests now underway with "copperweld" or copper-coated steel wire promising a future reduction of 82% in the copper used.

RCA's revised specifications for some of the parts that they buy point up some of the changes that may be expected in replacement parts. These include:

1. The cup over the end of the kinescope on the rear of the cabinet has been changed from aluminum to plastic.
2. Shorter mounting bushings on some variable controls, saving approximately 10% of the brass in these controls.
3. Reduction in the length of copper wire leads on paper and ceramic condensers (20% copper saving).
4. The use of copper clad steel wire instead of copper wire leads on wire-wound resistors and chokes.
5. The use of Alnico 3 magnets (no cobalt required) for beam benders, instead of Alnico V magnets.

Service Organization Activities

The unusual organizational progress of the Television Installation Service Association of Omaha, Nebraska, and

the effectiveness of its program is clearly indicated by the budding interest in other farm-belt cities in the formation of similar associations. Headed up by Jim Hustad, who is also secretary of the National Association of Television and Electronic Service Associations, the Omaha association was organized after Messrs Hustad and Briza made several trips to visit other organizations to observe their organizational structures and plans of operation.

Massachusetts radio and television service dealers were rudely shaken earlier this year when they discovered that a bill to license and regulate television servicing and sales in the Commonwealth of Massachusetts was in the legislative hopper. Benjamin S. Sims, president of the Boston chapter of the Radio Television Technicians Guild, reported to the members of the Guild that:

"As an indication of what almost happened, is the fact that licensing of all radio and television servicemen almost became a reality during the past few days. If the manufacturers and distributors for two major companies had not intervened and blocked the licensing plan we would have lost a business and the privilege of servicing television sets or radios until we secured a license."

While space in this column does not permit a discussion of the features of the bills that were presented to the Massachusetts legislature, it must be pointed out that if these regulations had become laws they would have tied the entire radio and television retailing and servicing industry as it is now operated in that state, in a straightjacket. Although we decry these political attempts to regulate our businesses we would be less than honest if we didn't point out that the entire industry — manufacturers, distributors, dealers, and service operators—have been really asking for it in their pusillanimous efforts to solve the basic problems of the retail selling and servicing of television receivers. The growing concern and alarm of the National Better Business Bureau over the continuing flood of user complaints that keep flowing into BBB offices from coast-to-coast indicate that if the entire industry doesn't get together to correct the evils that beset the business—politicians will.

Television Associates, Inc., of Washington, D. C., is carrying out a program to unite the service industry in the capital. Originally organized as an association of television installation and service contractors the organization structure was revised to include radio service dealers and service technicians.

"TV Tuner"

What is undoubtedly the most pretentious house organ ever launched by a radio or television service association made its debut in Philadelphia recently. It's title is the "TV Tuner" and it is the official publication of the

Television Contractors Association of Philadelphia. Edited by Paul V. Forte, executive secretary of the association, it pioneers an idea that can be indispensable for expanding the interest and active participation of good radio and television service businessmen in cleaning up the service phase of television in their local areas.

The initial issue, a twelve-page, 9 x 12 slick paper edition, is devoted chiefly to news of the many activities of TCA, its officers and its members. However, we were particularly impressed with one article in this issue that is typical of the incisive thinking of this association in matters that affect the television servicing industry.

The article, titled "Banks Asked to Recognize Their Position in TV Industry," points clearly to one potential control factor to prevent contracts for the initial installation and service of new receivers from getting into the hands of incapable or unreliable service operators.

"Banks and various credit agencies are some of the little known members of the television industry. Without money and credits TV, like any industry, would fold up and die. These agencies have profited greatly from the efforts of manufacturers, distributors, dealers, and service contractors but they have disclaimed any responsibility to the industry other than providing money at a profit.

"For a long time many service contractors, including the members of the Television Contractors Association, have been trying to tell the banks that they should develop an interest in television service. They have tried to point out that if service were poorly or dishonestly handled it would seriously interfere with their collections on the 'paper' they handle.

"The time is at hand, the Television Contractors Association believes, when banks and credit agencies should take drastic steps to insure their loans by making sure that all financed sets are serviced by competent and reliable contractors.

"The banks have the biggest weapon of all—money!—in helping the industry to rid itself of the undesirables, the fly-by-nights, the unscrupulous, the ignorant, and the incompetent. They should cooperate with the Television Contractors Association in helping to establish standards of responsibility and performance for the entire industry in Philadelphia, and then make certain that no contractor who cannot meet the requirements handles any set they finance."

Organization officers who would like to examine a copy of the "TV Tuner" should address their requests to: Television Contractors Association, M I T Corporation Building, Philadelphia 3, Pa.

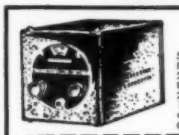
TISA Plugs Industry Problems

The Television Installation Service Association of Chicago has been pounding on the doors of industry for a long time seeking recognition for the tele-

TOP ITEMS AT LOWEST PRICES

RADIO STANDARD SURPLUS ELECTRONICS

BC-438 BEACON RECEIVERS



Similar to BC 1206. Manufactured by Detrola Radio. 200 to 500 KC. For Direction Finder. Contains 2—25L6, 1—6SA7, 1—6SF7, 1—6SK7, 1—6K7. Excellent condition. Complete **$7.95**

BC-357 / BC-1033 **FREQUENCY RANGE.** 60 to 80 Meg. Operates from 24 Volts D.C. With Tubes ..... **$3.95 / 4.95**

2 VOLT WET CELL RADIO BATTERY

NEW. Uncharged (Appr. wt. 4 lbs.) TYPE 20-2 ..... Ea. **$1.45**

Complete set of three with Box and Connections to make a 6 volt, 20 Amp. Hrs. Battery Uncharged (Approx. wt. 15 lbs.) ..... Set **$5.95**

MG-149F INVERTER

Input 24 Volt DC 36 Amps. 110 v. 400 Cy. AC. 500 V.A. Output at 90% P.F. Used, excellent condition ..... **$8.95** ea.

MIDGET SELSYNS

AY type operates from 6-12 Volts 60 Cycl. Use as both transmitter and receiver. These compact little units draw almost no current and work fine for all remote position indicating applications. OD 2¼x2¼x2". All New (Appr. wt. 1 lb.) ..... Each **$1.50**

PROP PITCH MOTORS

For your Beam Antenna: 20 Volt to 32 Volt, A.C. or D.C. ½ H.P. Motor; 1¼ RPM Gear Reduction, 7000 to 1. **ALL BRAND NEW** ..... **$13.95** ea.

DYNAMOTORS

CW 21218. 330 Volts @ 170 MA Output. 12 Volts DC Input. New ..... Each **$7.95**

COMMAND RECEIVERS

3 MC to 6 MC ..... **$6.95** ea.
6 to 9 Meg. ..... **6.95** ea.
Approx. weight of each 12 lbs.
All used but complete and in good condition.

COMMAND TRANSMITTERS

3 to 4 MCS **$14.95** ea. 5.3 to 7 Meg. ..... **$4.95** ea.
7 to 9 Meg. ..... **$14.95** ea.
Complete with Tubes and Crystals, excellent condition.

BC 456 MODULATION UNIT

Part of SCR274N. Equipment contains Relays, Transformers and 1J5, 1625 and VR 150 (OD3) Tubes.
Less Tubes **$1.50**
With Tubes **2.95**

CONDENSER BUYS

2 UFD 4000 VDC Pyranol **$2.95**
1 UFD 600 VDC **49c**

WALKIE TALKIE BATTERIES

BA 37—1½ volt—A **50c**
BA 38—103½ volt—B **$1.29**
Both for **$1.50**

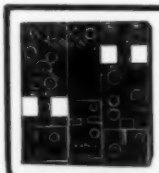
SOLDERING IRONS

Famous Name Manufacturer. 85 watt Iron. Only special purchase permits this low price, which is much less than standard advertised price.
All brand new ..... each **$2.95**

RU 16 RECEIVERS

RU 16 RECEIVERS ..... **$5.95** Ea.
Plug-in Coils.
9 Ranges 190-13570 KC ..... **1.50** Ea.
BC 430 Transmitter ..... **5.95** Ea.
Plug-in Coils for Trans.
2 MEG-9 MEG ..... **1.50** Ea.
12 Volt Dynamotor for above, 330 Volt @ 170 MA ..... **7.95** Ea.
RU-19 Control box ..... **1.00** Ea.

MODEL GO-9 TRANSMITTER



All brand New. 100 Watts CW, or MCW, emission. Operates from 110 V., 800 Cycle, easily converted to 60 Cycle operation. Low frequency range, 300 KC. to 600 KC. High frequency 3,000 KC. to 18,000 KC. using an E.C.O. We furnish complete conversion data with each transmitter. Complete with schematics **$59.95**

RU-19 RECEIVERS

For the first time on surplus, we can now offer this versatile Receiver. All complete and ready for 12 volt operation. These units are ideal for ship-to-shore receivers, ADF, and mobile operation. They come complete with 9 coils covering frequency range of 195 KC to 13570 KC. 12 volt Dynamotor, all interconnecting cables, remote tuning head and cables, spare tubes, tuning meter, instruction manual, junction box, mounts, etc., etc. **NOTHING ELSE TO BUY.**
ALL BRAND NEW, COMPLETE **$39.95**

METERS

Westinghouse—G.E. Weston

MILLIAMPERE D.C.

3"—0 to 50 .. **$3.95** Ea.
3"—0 to 100 .. **3.95** Ea.
3"—0 to 150 .. **3.95** Ea.
3"—0 to 200 .. **3.95** Ea.
3"—0 to 250 .. **3.95** Ea.
3"—0 to 500 .. **3.95** Ea.
3"—0 to 750 .. **3.95** Ea.

KILOVOLT D.C.

3"—0 to 400 DC. **$3.95** Ea.
3"—0 to 500 DC. **3.95** Ea.
3"—0 to 4 ... **3.95** Ea.
(All are 1 Ma. full scale, require external multiplier.)

VOLT METERS

3"—0 to 8 AC .. **$2.95** Ea.
3"—0 to 15 AC. **2.95** Ea.
2"—0 to 30 DC. **3.95** Ea.
3"—0 to 150 DC. **3.95** Ea.

2" WESTON SPECIAL

0 to 30 V. DC and 0 to 120 Amps. DC **$3.95** Ea.
0 to 30 V. DC and 0 to 240 Amps. DC **3.95** Ea.

TIME HOUR METERS

99999.9 Hrs.
10-12 Volts, 60 Cycle 3 Inch ..... **$6.95** Ea.

RADIO COMPASS RECEIVERS

RS-ARN 7—190 KC to 1,750 KC **$34.95**
MN 26—150 to 1500 KC **$34.95**
BC 453—190 to 1750 KC **$24.95**
All in excellent condition, with tubes.

ALTIMETERS

Sensitive type—Ideal for planes or automobiles. 0 to 40,000 ft. Operate from Barometric pressure. No special hookup needed. Excellent condition.
Low priced at ..... Ea. **$7.95**

MISCELLANEOUS SPECIALS

9 Channel Push Button Switch, spring back type **$1.00**
300 OHM Twin Lead ..... **.04** per Ft.
67½ Volt Radio "B" Batt. ..... **1.00** Ea.
1 Lb. Roll Rosin Core Solder ..... **.95** Roll
BC606G Interphone Switch Box ..... **.59** Ea.
RG 7U COAX 950 OHM ..... **.06** per Ft.
J-5A Hand Keys, Flameproof, New ..... **.69** Ea.

FL-8 FILTER

Range or Voice for 1020 cycles Audio. Switch mounted on Filter. Excellent for C W ..... Ea. **$1.25**

DESK TELEPHONES

French Type, Western Electric, Kellogg Monophone, etc. Can be used for rural service, extension phone or remote control apparatus.
With Dial **$12.95**
Less Dial **9.95**

GIBSON GIRL

The Emergency Radio Transmitter. Send S O S signals automatically on 500KC. 150-mile range. No batteries required. Has handdriven generator, tubes, carrying case. New. It's only ... **$5.95**

BLACKLITE UNIT

4 Watt Fluorescent Lamp mounted in a gooseneck holder. Starter mounted in base. Requires only 500 OHM Resistor in series with line for 110 V. AC operation. Ideal for radiation of Fluorescent Minerals or Material. New ..... **$1.95** Ea.
Extra 4 Watt Blacklite Lamp ..... Ea. **$1.00**

DC GENERATOR

12 Volt DC Output @ 4 Amp. Must be belt-driven @ Approx. 2000 RPM. In good condition ..... Ea. **$4.95**

JEEP GENERATORS

12 Volt DC Output @ 60 Amp. Complete with Voltage Regulator and Ammeter. Ideal for Boats, Trucks or Mobile Radio use. Excellent condition **$49.95**

12 VOLT BLOWER MOTOR

Trade Winds Blower—Operates from 12 Volts DC @ 6.6 AMPS. Diameter of cage 7". Ideal for Boats or Trucks. In good condition **$4.95**

POLE INSULATORS

Glass 2" Insulator with 3" screw overall length 5" for telephone use **$10.00** Hundred

BRASS SELSYNS

Heavy Duty Bendix Selsyns. 110 volts 60 Cycles AC. ..... Pair **$9.95**

GYRO MOTOR UNITS

Dual gyro unit. Both gyro motors mounted on single base. Wired in parallel for 12 or 24 volts. Excellent condition. (Please specify if you wish the 12 or 24 volt) ..... Set **$4.95**

SOUND POWERED HAND SETS

TS-10 type—Various manufacturers. No batteries needed for operation. Use in pairs with wire. Audible up to 10 miles. Ideal for TV antenna installations, etc.
Excellent condition ..... Pair **$17.95**

PE 110 POWER SUPPLY

This unit was used as part of BC669 transmitter. Input 110 volts 60 watts; Output 545 volt @ 455 ma. for transmitter and low voltage supply for Receiver and Filaments. Uses 4-5Z3 tubes for high voltage and 1-80 tube for low voltage. Also contains a 12 volt Vibrator pack for Receiver voltages. This supply is well filtered and regulated and is ideal for your Ham transmitter. Low priced at **$34.95**

INTERVALOMETERS

This unit was used to release bomb loads at different time intervals and now can be used ideally for dark room timers, etc. Complete with two 2050 tubes; four sensitive relays and other related parts. Excellent Condition ..... Each **$4.95**

TG-5 CODE OSCILLATOR

Battery operated Code Practice Oscillator. Use singly for practice or can be used in pairs for practice or sending messages over wire between two points. Uses a 22½ volt dry cell battery and 2 flash light cells. Contains keying relay and 1000 Cy. tone buzzer and head set. All brand new, with canvas carrying case ..... Ea. **$9.95**

BC-605 INTER-PHONE AMPS.

(See conversion of this Unit on Page 140 in April issue—Radio-Telv. News). Ideal for Inter-Com; Office to office; airplane inter-com, etc.; Complete with Tubes, Diagram and Case. Easily converted. **Excellent condition. OUR LOW PRICE** ... **$3.95** ea.

MINE DETECTOR, AN/PRS-1

Easy to operate, easy to carry. Can be used for detecting ore deposits, both metallic and non-metallic. Now being used extensively by Miners, Prospectors, Beachcombers, and Explorers. These sets are brand new and come complete with Detector head with antenna; Reflector meter and housing and exploring rod; a bag for carrying equipment while operating and a wooden case for storing or transporting unit when not in use. These units contain Tubes, and instruction books. Shipping weight is 125 lbs. Weight when operating unit is 22 lbs. All New—Complete with Batteries and ready to operate ..... Set **$29.95**
SCR-625 MINE DETECTOR.
Complete with batteries **$59.50**

HAND SIRENS

All New, with canvas cover carrying strap. Can be heard for many miles. Ideal for Civil Defense, Camps, etc. A bargain at ... **$9.95**

G.P.7 TUNING UNITS

6 Ranges: A-350-800 KC., B-800-1500 KC., C-1500-3000 KC., D-3000-4525 KC., E-4525-6500 KC., F-6200-9050 KC.
Also contains Capacitors, Resistors, Vernier Dials and many other parts. A REAL BUY while they last. Each unit range **$4.95**

WATERTIGHT SWITCH BOXES

Contains ten DPST toggle switches and one terminal board, completely wired up in a watertight case. All new ..... Each **$3.50**

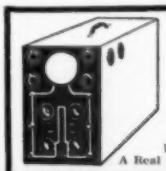
ANTENNA RELAY UNITS

Contains a Weston RF Meter; Thermo-couple, sensitive relay and a 50 Mmfd. 5000 volt vacuum condenser. All in case. Excellent condition. Each **$2.50**

TUBES

8025	**$4.95**	4E27	**$12.95**
3FP7	**1.95**	8020	**2.95**
5FP7	**1.25**	6SL7	**1.25**
5BP4	**2.50**	6V6	**1.25**
6SC7	**1.00**	6E5	**.75**
6SJ7	**1.00**	6U5	**.75**
6SR7	**.90**	6S8	**.75**
12SR7	**1.50**	83V	**1.25**
6AG5	**1.50**	6SH7	**.50**
6AK5	**1.75**	5Y3	**.50**
6AC7	**1.50**	6SN7	**1.75**

3" TRIUMPH OSCILLOGRAPH



Complete Test Scope, with built-in Wobbulator, so as to be used on TV or FM servicing. Operates from 110 Volt, 60 Cy. A.C. Limited Supply. All these units have been carefully checked and are in excellent condition. A Real Buy. **SPECIAL** **$34.95** Ea.

All Mail Orders Promptly Filled, F.O.B. San Francisco . . . All California Orders—Add 3% Sales Tax . . . . Do not send postage stamps. Write for our free booklet listing our stock and prices on Radio, Electronics, Tools, Hardware, Motors, Wire, Meters, Batteries, Aluminum Sheets, etc. 20% Dep. on all C.O.D. orders. All items subject to prior sale.

STANDARD SURPLUS

1230 Market St., San Francisco 3, Cal.
Telephone HEmlock 1-3106

vision contractor and service dealer as an important factor in the industry. Frank Moch, the untiring and ruggedly persistent president of TISA finally broke through one of the barriers recently and was invited to sit in on a meeting of the RTMA with the National Better Business Bureau for a discussion of television consumer problems.

Although no official releases were issued concerning the subjects that were discussed at these meetings it is reliably reported that the BBB's are particularly incensed over the "in-warranty" parts debacle. This certainly should not have surprised anyone at this meeting for it has been pointed out repeatedly by TISA, TCA, and other service contract organizations—men who know from daily experience the real causes of the festering sores of consumer complaints—that the "in warranty" parts racket would sooner or later get the entire television industry into a mess of sizzling hot water.

When we see men in industry blandly ignore the glaring faults of their own segment of activity we find it easy to recapture the picture of "Honest" Jake Malik and his ingenuous statement to the UN delegates that, "Russians are free people; they can go where they want and work where they want. Everybody knows that." —30—

International Short-Wave

(*Continued from page* 63)

"We do not broadcast programs in *English,*" Mr. Gallo explains, "but make identification in that language, usually every 15 minutes. All reports —that is, correct ones—are verified by letter. IRC's are not good in this country; therefore, we are asking DX-ers to remit a 10-cent U.S. postage stamp for return reply—or 10 cents in U.S. coin."

Our best wishes go to both ELBC and YNDG for long and successful careers in the field of short-wave broadcasting!

* * *

What's Ahead?

Donald Fox, Washington, D.C., has supplied us with these interesting excerpts from an article by T. W. Bennington in *"London Calling"* (organ of the British Broadcasting Corporation) regarding reception conditions on short-waves used by the BBC in its overseas services, and forecasting that decreasing sunspot activity in 1951 will mean, in general, more and more use of the longer of the short-wave bands. In part, Mr. Bennington, wrote:

"Short waves travel to their destination by way of the reflecting layers of air in the upper atmosphere—the ionosphere, as it is called. The ionosphere is produced by the sun, and its condition—and hence the conditions for transmission of the short waves—varies with the sun's activity.

"This activity varies constantly, and is indicated by the sunspots, which wax and wane over a period lasting,

on the average, about 11 years. Thus, the sunspot activity increases towards a maximum and then decreases towards a minimum again, which variation is the well-known sunspot cycle.

"When sunspot activity is at a maximum, the condition of the ionosphere is such that the shortest of the short waves are best transmitted; when the minimum approaches, the shorter short waves fail, and more and more use of the longer short waves must be made.

"The sunspot activity reached its last maximum in 1947, and since then it has been decreasing, though it has done so in a far from regular manner. Up to the end of 1949, in fact, the downward trend was only faintly apparent, but during 1950, and particularly during the latter half of the year, the general decrease in sunspot activity became much more rapid . . .

"How, then, is the situation likely to change during 1951? Well, no one has yet succeeded in accurately forecasting the sunspot-cycle changes for very long ahead, so we should, perhaps, be a little diffident in making precise statements about things which are entirely dependent on them—like the useful wavelengths for short-wave broadcasting.

"But of one thing we can be fairly sure: the sunspot activity will go on decreasing—or, at least, will not show any very large subsidiary increase—until it has reached a value something like that which prevailed in 1944, the year of the last minimum.

"Whether it will continue to decrease at its present rate is very difficult to say, but the chances are that it will not: that is to say, the activity should soon begin to decrease more slowly. So the ionospheric critical frequencies, following the sunspot number, may, during 1951, continue to decrease, but, after a time, begin to do so at a decreased rate.

"During 1951, therefore, the wavelengths of most use for short-wave broadcasting are likely to become even longer than they are at present, and account will have to be taken of this. Of course, there will be the usual seasonal changes in the transmitting schedule, but, over and above these, there will be a general tendency—forced upon us by the changing conditions—to make more use of longer wavelengths.

"During the summer it is probable that 11 meters will fail in southerly directions, and that 13 meters will be of less utility than at present. For daytime broadcasting, more use will therefore have to be made of the 16-meter and 19-meter bands. But it is at night-time that things are likely to become serious. During the summer, all should be well, the 25-meter and 31-meter bands being usable over many circuits. But next winter only 42 and 49 meters are likely to be usable for nearly all services.

"And, unfortunately, as increased use of these bands will be made by nearly all the world's broadcasting

services, the congestion in them is likely to be severe. A considerable amount of interference is, therefore, to be expected.

"Summing up," says Mr. Bennington, "we may say that during 1951 sunspot activity will most likely go on decreasing, and, as a result, the shorter wavelengths now in use, both by day and night, will become of less utility. During the summer, the situation is not likely to become severe, but, during the winter, and particularly at night, the crowding of stations into the only usable bands of 42 and 49 meters is likely to cause some increase in mutual interference."

* * *

This Month's Schedules

(NOTE: During May, some stations may change to Summer Time; in such cases, you may find schedules *one hour earlier* than listed herein.—KRB)

Albania—Radio Korce is now audible on 7.950 weekdays 0100-0200, Sundays 0200-0300; daily 0800-0900, 1145-1430; output is 100 watts; sometimes the frequency is altered and the modulation is still very poor. (Radio Sweden)

Algeria—Radio Algerie has *two new* short-wave transmitters under construction, according to a recent *ISWL* Bulletin from London.

Angola—Ridgeway, South Africa, reports Nova Lisboa on 5.093, good level at 1545; also heard well on 11.925 sometimes around 0600 with Portuguese music.

Argentina—LRT, 11.840, Tucuman, noted 2230 and signing off in Spanish 2250. (Guzman, Cuba)

Australia—VLX, 4.8975, Perth, noted 1040 and signing off 1100 with "God Save the King." (Pearce, England) Correct call is VLX and correct frequency is 4.8975. (Hutchins, Radio Australia) VLM, 4.9175, is heard with music and ending test at 1457; time pips at 1500, then news from the ABC, local news, weather, early morning market reports, then music. (Pearce, England) This is correct frequency and correct call. (Hutchins, Radio Australia) Both these outlets are heard fair-to-good mornings here in West Virginia.

VLI3, 9.500, Sydney, N.S.W., noted with weak signal after XEWW, Mexico City, leaves that channel 0110. (Grove, Ill.)

Reports to Inland Stations in Australia should be addressed to the Australian Broadcasting Commission in the city from which the station operates. *Radio Australia* recently has been behind in answering hundreds of reports, but hopes to "catch up" soon. (Hutchins, Radio Australia)

Austria — Blue Danube Network, 9.617, Salzburg, noted 0600 with news resumé; sports headlines at 0605; noted another day 0500 with news headlines followed by recordings.

Azores—CSKA, 4.845, noted daily around 1700; announces "Emissora Regional dos Acores" frequently; easy to identify. (McWalter, Scotland)

G.I. FREE SCHOOLING DEADLINE NEARS

VETERANS of World War II are reminded that the educational feature of the G.I. Bill expires for most veterans on July 25, 1951 and that those who plan to enter school or enroll for correspondence school training must act quickly.

The great majority of such veterans must start their training and actually be enrolled in the school of their choice by July 25th or forfeit their educational benefits. Veterans discharged after July 25, 1947 have four years from their discharge date to start their training.

According to information received from the Veterans Administration, a veteran must be in training on July 25th unless he has temporarily interrupted his course for summer vacation or for other reason beyond his control.

Once he completes or discontinues his course of G.I. Bill training after the deadline, he may not start another course. Also, he must meet the following two post-deadline requirements.

1. He will be expected to pursue his training "continuously until completion except for conditions which normally would cause interruption by any student."

2. He may change his education objective "only while in training and then for reasons satisfactory to the Administrator." Public Law 610, which permits a veteran to make a first change of general fields of study merely by applying for it, will not be in effect after the cut-off date.

Special consideration will be given to four categories of veteran-trainees who, for reasons beyond their control, either may not be able to resume their training by July 25, 1951, or may not be in a position to remain in continuous training afterwards.

The categories are: 1. Veterans who have started G.I. Bill studies and interrupt them to go back into active military or naval service; 2. Veterans who complete premedical and predental G. I. Bill schooling and can't get into a medical or dental school by deadline time; 3. Teachers who spend their summers taking training leading to a degree; and 4. Those who complete G.I. Bill undergraduate courses and intend to go ahead with graduate training which would start after the deadline date.

The Veterans Administration emphasizes that most veterans may not receive training after July 25, 1956, the wind-up date of the program. The only exception to the final date are those who enlisted or re-enlisted between October 6, 1945 and October 5, 1946 under the Armed Forces Voluntary Recruitment Act. Those veterans have four years from the end of their enlistment or re-enlistment period in which to begin G.I. Bill training, and nine years from the end of that period in which to finish.

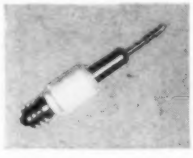
Veterans who are in doubt about their status under the educational feature of the G.I. Bill should contact their local Veterans Administration office immediately so that all of the formalities can be completed before the July 25, 1951 deadline.

—30—

Ungar's little Angels

DO A HEAVENLY SOLDERING JOB

Pick any job and you'll find a pip of a tip to use with the trim, slim Ungar Pencil. Any of the 8 Ungar Angels interchange in the No. 776 Handle to make a honey of a tool that does work faster and better than larger, heavier irons. Whatever your problem, you'll bless the day you discovered these saintly soldering cherubs!



No. 538 ⅛" CHISEL TIP, 20 Watts

For Light Duty Work. Especially recommended for Printed Circuits. Very useful for small joints and hard-to-reach points on radio and TV, electronic assemblies, aircraft instruments, hearing aid assembly and repair.

Write for Catalog No. 400

Ungar ELECTRIC TOOLS, INC., Los Angeles 54, Calif.

OPENING A NEW MARKET!

Spico INDOOR ALL-CHANNEL TELEVISION & FM ANTENNAS

REVOLUTIONARY NEW

Super-Phantom

MODEL TV-503

Provides BETTER reception over GREATER distances than any other indoor TV Antenna! Exhaustive tests prove that Super-Phantom sharply reduces, and in many locations completely eliminates ghosts and interference. Note these features:

- **ADJUSTA-KNOB** fingertip tuning control adjusts antenna to desired channel, for peak signal.
- **OPTIMUM MATCHING STUB** permits precision impedance matching of antenna to every type of set.
- Telescopic Plated Brass Dipoles for greatly increased gain.

Model TV-503 Super-Phantom. . List Price **$7.95**

PATENT PENDING

Adjusta-Knob

A new and more efficient method of adjusting antenna to each individual channel by "finger-tip" tuning control, for absolutely peak television signal.

And for LOCAL AREAS

"Spico" Phantom-Tenna (Pat. Pend.)

Similar to Super-Phantom described above, except dipoles are fixed length non-telescoping, only 17½" long. Phantom-Tenna is equipped with ADJUSTA-KNOB and MATCHING STUB described above. Adjusta-Knob eliminates need to telescopic adjustment. Plated brass tubing. Model TV-501 Phantom-Tenna. . . . . List Price **$6.95**

● **"Spico" Masterette**
Model TV-6 (Pat. Pend.)

Conventional portable indoor telescopic TV antenna for normal reception areas, neat, well-built, priced remarkably low! Model TV-6 Masterette. . . List Price **$4.95**

● **"Spico" Tenna-Master**
Model TV93B (Pat. No. 186379)

Beautifully designed indoor TV antenna, telescopic dipoles, with exclusive patented LOCK-NOTCH VERTICAL ORIENTATION, assures permanent non-skid automatic positioning, eliminates tightening or loosening of dipole elements. Model TV93B Tenna-Master. . . . . List Price **$6.95**

ALL "Spico" **Indoor TV & FM Antennas** feature Bakelite Housing and Base, concealed wiring, plated brass rods, 300-ohm connecting lead. Engineer-approved and sold by national known TV set Mfrs. Distributed thru jobbers only.

AT THE PARTS SHOW

You are invited to see our outstanding "Spico" line on display at our **Booth # 225** and on actual demonstration in Display Room **# 512-A.**

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SPIRLING PRODUCTS CO., INC. 62 GRAND ST., N.Y. 13, N.Y.

"One of America's Leading Manufacturers of TV & FM Indoor Antennas"

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WALSCO CONTACTENE INJECTOR

Permits application of contact chemicals to volume controls and switches without unsoldering connections or taking controls apart. Finest surgical-grade needle and oil-resistant, neoprene bulb. ONLY 45c DEALERS NET.*

WALSCO LUBRICATOR

Designed to reach the many cramped and hidden points in radio, TV sets and record changers. Ideal for applying light greases and oils. Syringe-type plunger releases desired amount of lubricant.

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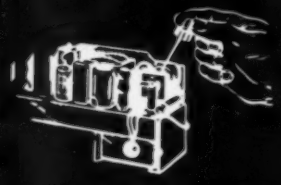

. . . AND SPECIFY FAMOUS QUALITY WALSCO RADIO CHEMICALS

CONTACTENE

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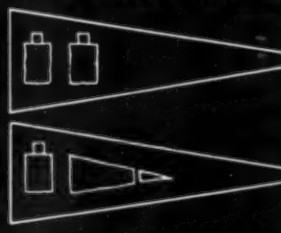
NO-OX

TUNERLUB



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Walter L. Schott Co.
Los Angeles 18, California
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* SOLD EXCLUSIVELY THROUGH JOBBERS EVERYWHERE. PRICES SLIGHTLY HIGHER IN CANADA.

Bechuanaland—ZNG, 8.242, Mafeking, is noted 1400. (OTC, Belgian Congo, via Grischott, Calif.)

Belgian Congo—Leopoldville's 11.650 outlet noted 2030, good level, with *English* announcement.

OTC2, 9.767, is scheduled daily 1100-1830 and 1830-0100; the "Amongst Friends Club" is conducted Tuesday, Friday, Saturday at 1410-1415 for Europe and 2210-2215 for USA-Canada. (Grischott, Calif.)

Bolivia—CP38, "The Southern Cross Radio Station," La Paz, on 9.505, sends information to Pearce, England, that it is British-owned, the property of the Canadian Baptist Mission in Bolivia; that it is considering an experimental broadcast in *English* on Friday nights after it closes its regular Spanish broadcasts; relays CP27 on 730 kc.; input power to the short-wave transmitter is just under 1 kw.; it is an evangelical, non-commercial station, and the QRA is Cajon 8, La Paz, Bolivia.

Brazil—PRL7, 9.72, Rio de Janeiro, is coming through well in Scotland around 1500-1600; announces "Radio Nacional." (McWalter) ZYK3, 9.565, has "Brazil Calling" at 1900-1930, at least on week-days; may be earlier on Sundays. ZYP23, 5.045, *Radio Quitandinha*, Petropolis, noted 2000 with music. (Dvorak, Ohio) ZYK3 asks for reports and says will verify with QSL. (Machwart, Michigan) ZYC8, 9.610, *Radio Tamoio*, Rio de Janeiro, signs off 2050. ZYC9, *Radio Tupi*, 15.370, Rio de Janeiro, is heard fair to good 1800-1830 in Portuguese. (Callarman, Oregon)

Bulgaria — Radio Sweden reminds

UNIQUE I.F. TURRET BOOSTER DEVELOPED

A UNIQUE i.f. Turret Booster that plugs into the i.f. amplifier of a television receiver and provides an additional stage of intermediate frequency amplification has been developed by Barb City Industries Inc. of De Kalb, Illinois.

To install the new circuit an i.f. amplifier tube in the receiver is removed and the tube thus removed is then placed in the bottom socket of the booster. The booster is then plugged into the empty i.f. socket on the receiver. A slight adjustment of the i.f. coil on the booster and of the following stage may be required to give the receiver the proper i.f. response. This is necessitated by the increased circuit capacity due to the additional lead length.

The circuit is an ordinary i.f. stage of amplification inserted in series with the plate lead of the i.f. stage of the receiver. See Fig. 2. Thus the output of the tube which has been removed goes to the input of the turret i.f. stage mounted above and the output of the turret i.f. stage is then fed back into the receiver socket.

Plate and screen voltages for the turret tube are taken from the screen connection of the bottom tube. Most receivers use a 1000 ohm resistor in the screen circuit from the "B plus" which is capable of carrying ample current to operate the turret tube. The filaments are in parallel, therefore the booster should be used only in receivers having parallel filament circuits. Nearly all sets having filament transformers will allow the additional .3 ampere filament current drawn which is all the current that is required when using the Turret Booster.

The new unit does not require tuning for each station selected because it operates on the intermediate frequency; it can be removed or installed without rewiring the receiver; it operates automatically when the receiver is turned on; and it increases the video output an estimated 15 to 20 per-cent in most receivers.

—30—

Fig. 2. Complete circuit diagram of new unit.

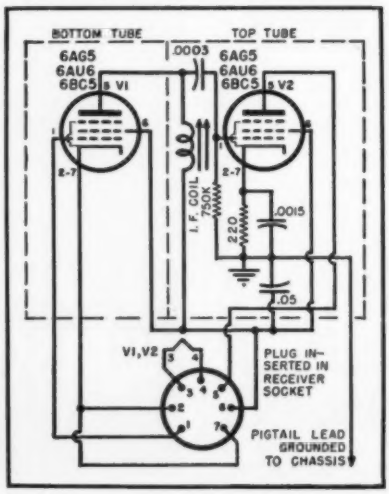
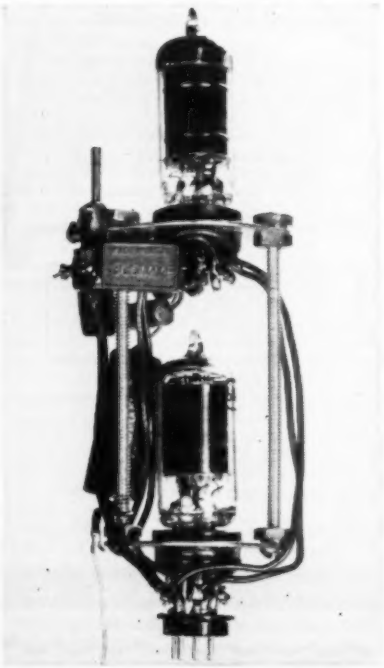


Fig. 1. Over-all view of Turret Booster.



that *Radio Sofia* III, 7.671, broadcasts *English* programs daily 0130-0145, 1500-1529, 1615-1630.

Canada—Current schedules of the CBC's International Service are listed — *European Service* — 0850-1130, CKNC, CKCX; 1130-1545, CKNC, CKCS; 1545-1600, CKCS; 1600-1645, CKCS, CKLO; 1645-1700, CKLO; 1700-1730, CKLO, CKRZ; 1730-1745, CKLO, and 1745-1830, CHOL, CKLO. *Australasian Service*—2330-0005 (*except* Sat., Sun.), commentaries from the United Nations, CKLX, CHOL; 0340-0450 (Sun. and Wed. *only*), CHOL, CKLO. *Caribbean and Latin American Service* — 1850-1630, CKCX, CKRA, and 2130-2235, CKCS, CKRA; *English* 2100-2130. Stations are CKNC, 17.82; CKCS, 15.32; CKCX, 15.19; CKLX, 15.09; CKRA, 11.76; CHOL, 9.63; CKRZ 6.06.

CBNX, 5.970, St. John's, Newfoundland, has been heard 1830-1900 as the band came in and *before* HI4T, Dominican Republic, took over on the channel; was very weak and had some QRM on the low side. (Lane, South Dakota)

On Saturdays 1615-1630, CHNX, 6.130, has Hawaiian program. (Bellington, N.Y.) This one noted signing off 2310 and asking for reports to P.O. Box 400, Halifax, Nova Scotia, Canada. (Fox, D.C.)

Cape Verde Islands—CR4AA, 5.895V, Praia, noted 1600-1630. (Lindahl, Calif.) Pearce, England, says this one appears to be moving about; he noted it recently on about 5.930 at 1530 sign-on, then news in Portuguese at 1535, followed by light music.

Ceylon—Radio Ceylon, 15.12, noted opening its Commercial Service 2045 and at 2100 with BBC news relay from London. (Ferguson, N.C.) Is heard mornings on approximately 11.975. Noted by Bromley, Ontario, on 9.52 with weak signal 2010; usually signs off 2030 on this channel.

Chile — CE1190, Valparaiso, noted with music around 1930-2000 or later. (Russell, Calif.) Verified in 11 months from Compania Chilena Comunicaciones S.A., Casilla 37-V, Valparaiso, Chile; slogan is "La Voz de Chile para toda America." (Callarman, Oregon) CE1174, 11.740, Valparaiso, noted signing off 2250. (Guzman, Cuba) CE622, 6.220, good usually around 2000-2200, then fades. (Lane, South Dakota) CE1180, 12.000, noted 2030. (Machwart, Michigan)

China — Radio Peking, 11.685 and 15.060V, still carries news 0835; also noted evenings irregularly around 1800-2100 in Chinese. Cushen, N.Z., says prisoner-of-war broadcasts are daily at 0450 on these channels, reports *Radio Australia*.

Colombia—HJDE, 6.145, blasts in nightly in South Dakota to approximately 2330 sign-off. (Lane) HJAP, 9.890, Cartagena, noted recently with fine signal 2000-2200. (Saylor, Va.) HJKE, 4.835, heard fair at 2345; HJEX, 6.054, Cali, noted with good level 2200; HJKD, 6.000, *Emisoras Nuevo Mundo*, Bogota, heard well 2300,

off 2330; HJWO, 6.270, *Emisoras Colombia,* Bogota, noted 0015, poor level; a *new* Colombian is heard on approximately 6.220, good signal; *Radio Nacional de Colombia,* is a good signal in Oregon on 4.960, 6.200, but is poor on 11.680, noted evenings. (Callarman)

HJPP, 6.135, Bogota, noted with music 2250 tune-in and at 2300 man announced in Spanish, played Ted Lewis' "Good Night Song," and left the air; good signal in N.Y. (Bellington)

Costa Rica—The 11.965 *Radio Athenea,* San Jose, is giving TIRS, TIHH as calls. (Stark, Texas) Is heard in Australia and New Zealand around 0730 and in New Zealand to sign-off 2300; relays medium-wave TIRS. (Radio Australia)

TIFC, 9.645, noted 2329 with religious broadcast; TIPG, 9.620, noted 2335-2350. (Machwart, Michigan)

Cuba—Havana has been noted lately on measured 9.8624, heard 1000, modulation very poor; music; may be COBL which hasn't been heard on listed 9.833 lately. (Oskay, N.J.) COCQ, 8.825, is heard best in Scotland around 1800. (McWalter) A Cuban was noted recently signing off 0029, with *English* announcement by man; frequency was 6.450. (Bellington, N.Y.) COBH, 11.80, noted 2355 to 0000 sign-off. (Machwart, Michigan) Is good level in Eastern USA day and night.

Czechoslovakia—Prague, 11.875, has news 0715-0745; asks for reports. (Pearce, England) Is a good signal here in West Virginia.

The 9.504 channel noted ending *English* at 1730 (starts 1715) in parallel with 6.170; noted on 9.504 with *English* at 1530. (Pearce, England)

Dominican Republic—"La Voz Dominicana," 9.735, is now carrying *English* on Monday, Wednesday, Friday 1900-1915. (*World Radio Handbook* Bulletin) Has been heard in *English* 2200-2215 on Wednesdays over the 9.735 channel. (Callarman, Oregon) Heard on a Monday with *English* in progress when tuned 2135; this continued to 2145 on both 5.970 and 9.735; asked for reports. (Bellington, N.Y.)

HI8Z, 4.980, Santiago de los Caballeros, noted 2030-2100. (Guzman, Cuba) HI1L, 4.950, "La Voz del Tropico," signs on 0610. (Callarman, Oregon) HI1J, 6.025, noted 2035-2100 sign-off on one occasion but may have been a special broadcast. (Machwart, Michigan)

Ecuador—HC2RL, 6.630, Guayaquil, noted 2100-2200. (Guzman, Cuba)

Egypt—SUX, 7.862, Cairo, has fair signal in South Africa, rather bad QRN usually; native music noted 1430; is heard until 1600 most days. (Ridgeway)

El Salvador—YSUA, 6.250, San Salvador, has programs with examples of different types of American music at 2330-0000 sign-off; good level in Oregon. (Callarman) San Salvador, 7.270, heard signing off 2302. (Fox, D.C.)

Fernando Po—Although it may be some time before the projected 200 kw. transmitters come into use at Fernando Po, I am reliably informed there is a low-powered transmitter operat-

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1 FREE RADIO TUBE (OUR CHOICE) SHIPPED WITH EACH PARTS ORDER OVER $5.00

SAVE HOURS OF HARD WORK

Do the job in minutes with a BUFRAD Socket Hole Punch. Cut clean accurate holes for sockets, plugs, connectors, etc. Cutting holes in radio chassis is as simple as cutting butter with a hot knife with a BUFRAD punch. Just insert the punch in a ⅛" hole and turn with an ordinary wrench. In a minute or less you can complete a job which often takes an hour with the old "drilling, reaming, and filing" method. With BUFRAD punches you can make 13 different sizes of openings from ½" to 2¼" diameter.

½", ⅝", ¾", ⅞" sizes $2.08
1", 1 1/16", 1⅛", 1 3/32", 1 3/16", 1¼" sizes.. $2.42
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SIGNAL GENERATOR

Genuine Laboratory-type precision signal generator Manufactured and sold for $68.00 each in large quantities during the war by Northeastern Engineering Corp., one of the top manufacturers of electronic equipment for the U. S. Govt. Five fundamental bands starting at 150 KC. Strong harmonics up to 120 MC. Five step ladder type attenuator as well as potentiometer output control. Regular 1000 cycle audio oscillator using vacuum tube, not a cheap neon sawtooth audio oscillator. Audio output separately available externally. Weight without packing material 16 lbs. which should show what a world of difference exists between this signal generator and the ordinary cheap oscillator used by the average serviceman. Complete with fused plug and coaxial output lead. Super Special **$28.75**

$6.95 TAKES ALL THREE BIG BARGAINS "E"

1. **AUDIO AMPLIFIER**—Brand new push-pull output triode amplifiers having 2 of the valuable and scarce ounncer type audio transformers that sell for over $10.00 apiece. Neat aluminum case, fully enclosed (largest dimension 6 inches). Perfect for intercom systems, phone amplifiers, mike amplifier, or signal tracer amplifier for testing radio sets. A sensational bargain at only ..... $3.40 each
2. **BANDSWITCHING TUNING TURRET** made by Western Electric. Covers 4 bands above 100 MC. All coils wound with #14 silver-plated wire. Complete with tuning condensers and powerful electric driving motor. ONE OF OUR MOST TERRIFIC VALUES—ONLY $3.95
3. **CARBON MIKE** with Push-To-Talk Switch and Gold Plated Carbon Lapel Mike. Combination offer on both mikes $1.75

Supreme Instruments Corp. Model 562 Audolyzer. A practical system of signal tracing that tells you the trouble quicker. Makes relative gain measurements.

Shows actual gain or loss of a stage, a tube, or a transformer on the built-in vacuum tube voltmeter, which has ranges of 1, 3, 10, 30, 100, 300, 1000 volts, and resistance ranges of 200, 2000, 200 K., 2 meg, and 20 megs. Distortion sources instantly located. Frequency meter in Audolyzer measures unknown frequencies of oscillators or RF coils. Read actual IF signal's frequency on the Audolyzer dial! The Audolyzer is electrically divided into 2 sections, thus it is possible to signal trace using 2 probes, in 2 directions at the same time; from output end, toward antenna, and from antenna end, toward output, locating intermittents in a minute or two. Bad condensers quickly located without unsoldering. Field strength feature of Audolyzer accurately checks antenna efficiency. Check high impedance pickups without other apparatus. Check receiver's speaker against Audolyzer's speaker for output quality. Factory circular on this sensational instrument available on request. Regular price **$149.50 SPECIAL $99.00**

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4-Hole Blade, Takes Wires Up To ¼" O.D. Gauges No. 14 and Smaller. Sold on a money-back guarantee, NOW **$2.95**

Super Midget Mike Xfmr.

Occupies less than ¼ cu. in. of space. This is the tiny, high quality transformer that is used inside button dynamic or velocity mikes to match the input of an amplifier tube. Makes a terrific intercom set input xfmr to couple from the voice coil of a speaker to the amplifier input. Better quality and marked reduction in hum compared to other transformers. A beautiful input xfmr for a transceiver because of high quality & light weight. Special **$1.00** Postpaid.

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Accurate and precise 2 speed guaranteed hobby lathe, the essential machine for the home workshop. Sturdy enough for light production work or factory standby service. Supplied with 56" of belting for connecting to any available electric motor or power take-off. Also included in this unbelievable offer are such accessories as a ½" drill chuck with specially hardened tool steel jaws, a 4" electric furnace high speed grinding wheel, a cotton buffing wheel and a large supply of buffing compound, and a 4" steel wire scratch brush. Your cost **$6.00**. Sole export agent. Distributor inquiries invited.

SENSATIONAL, FASCINATING, MYSTERIOUS SELSYNS. Brand new Selsyns made by G.E. Company. Two or more connected together work perfectly on 110 V AC. Any rotation of the shaft of one Selsyn and all others connected to it will rotate exactly as many degrees in the same direction, following unerringly as if the units were connected together by shafting instead of wire. This is true whether you twist the shaft of the master unit a fraction of a revolution or many revolutions. Useful for indicating direction of weather vanes, rotating directional antennas, or controlling innumerable operations from a distance. Complete with diagram and instructions. Per Matched pair **$4.95**.

SIGNAL CORPS INTERCONNECTOR RELAY BOX 730A

This valuable unit, made by Bell, and more familiarly known by the U. S. Army designation BC616, is encased in a highly polished aluminum case 6½x5½x2½", and contains 150 mfd of condenser capacity, sensitive relays, resistors, and terminal strips. Order several at the give-away price of only $1.95

Highest quality telescoping folded dipole rooftop type antenna. Tunes to all channels. With all the features usually expected in such an antenna, including use as dipole and reflector, and in addition a mounting bracket provided so that the antenna can be installed in any window in two minutes or less. Any slight loss in gain because of the reduction from rooftop height is more than compensated by the ability to orient the antenna instantly by opening the window and adjusting for maximum signal strength. Mounting bar can be installed horizontally or vertically in window frame or even between attic rafters, whichever is most convenient. Your cost $8.65. With high frequency attachment for channels 7 to 13 **$11.00**. Either type 10% less in dozen lots.

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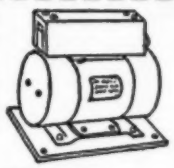
6 Volt Dynamotor



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- Both sides of output voltage insulated from ground
- Brand new in original factory boxes
- Both input and output fused
- Built-in interference filter

• Special . . . $39.95

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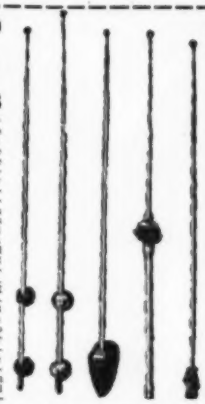

All of our car radio antennas are made of triple plated Admiralty Brass Tubing, complete with low loss shielded antenna leads and lots of 12 high quality fittings.

SIDE COWL—BR-1. 3 sections extend to 66". Your price—single units—**$3.25**, in lots of 12 or more—**—$2.00 ea.**

SKYSCRAPER—BR-2 has heavy duty sections that extend 98". This super-aerial must be seen to be fully appreciated. Your price—single units—**$3.00**; in lots of 12—**$2.50 ea.**

TILT ANGLE—BR-3, may be adjusted to all body contours, 3 sections extend to 66". Single unit price—**$2.99**; 12 lot price—**$1.75 ea.**

VERSATILE—BR-4, single hole fender or top cowl mounting may be adjusted to conform with all body contours. 4 sections extend to 56". Single unit price—**$3.50**; 12 lot price—**$3.00 ea.**

THE MONARCH—BR-5, single hole, top cowl mounting, 3 sections extend to 56". Single unit price—**$2.90**; 12 lot price—**$2.00 ea.**

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No adjustment required, use in field strength meter, noise limiters, signal tracer probes, wavemeters, or as 1st or 2nd detector. The world's finest detector for crystal sets. Higher efficiency and much greater volume. **5.75** or 3 for **$1.95**.

25 or 60 cycle Filament Transformers

115V to 12V, 3A..... $1.35
115V to 12V, 2.5 A & 6.3V, 3A.. $2.00
250V to 25V, 1.5A..... $1.35

Phono motor and turntable, and phono pickup with G.E. reluctance pickup cartridge. Total price..... $7.95

Storage Batteries

Large Navy Type Storage Batteries 6V-250 Ampere hours. Shipped Dry, shpg. wt. 90 lbs. Special... $25.00

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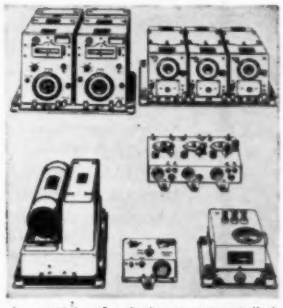
GENERAL ELECTRIC 15 TUBE TRANSMITTER-RECEIVER SET. This brand new 15 tube transmitter-receiver was designed for mobile storage battery powered service. Properly modified, it will operate on voice in the Citizens Band. It's a cinch for the experimenter to connect this unit for 110-volt a.c. operation by following the instructions and diagrams supplied, which cover numerous applications, including FM and amateur television transmission and reception. For those intending to use on car or boat, a new dynamotor, exactly as originally supplied, costs only $39.95. Don't fail to write for FREE descriptive bulletin. Order our RT-1248 for only **$29.95**, or two for **$53.90**.

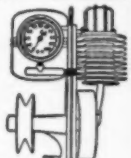
Admiral Record Changers in metal cabinet. Play 12-10" or 10-12" records. Latest high output featherweight Shure Crystal cartridge. Free removable permanent needle. Original factory carton. Worth double our price of **$18.00** complete.

SCR 274N Command Set (Made by Western Electric) THE GREATEST RADIO EQUIPMENT VALUE IN HISTORY



A mountain of valuable equipment that includes 3 separate Communications Receivers, covering up to 9.1 MC. 2 separate 40 watt Transmitters including crystals. 4— 28v Dynamotors (easily converted to 110v AC operation). Pre-Amplifier and Modulator, 2 Tuning Control Boxes, and 1 Antenna Coupling Box complete with R.F. Ammeter. 29 tubes supplied in all. Receivers and Transmitters instantly detached from mounting racks for use in separate locations. Removed from unused aircraft and in guaranteed electrical condition. A super value at **$89.95** complete.

COMPRESSED AIR INSTANTLY ANYWHERE



Portable Air Compressor and storage tank. Ruggedly built. Best Materials. Lifetime lubricated ball-bearing on connecting rod and oil-impregnated main bearing on shaft. Unusual design forever eliminates valve trouble, the most common fault in air compressors. **PATENTED** unique air intake system increases efficiency tremendously so that air output is much greater than that from larger compressors powered by heavier motors. Delivers approximately 3500 cu. inches of air per minute at maintained pressure of 30 lbs., or will inflate a 90 lb. truck tire in less than one minute. Complete with 100 lb. gauge. Finger-tip adjustment allows setting of output pressure at any value, which will automatically be maintained. Works from any ¼ H.P. motor. Useful for spraying paint, lacquer, disinfectant, insecticide, annealing or brazing with natural gas, inflating tires, etc. Price **$14.50** postage prepaid anywhere in the U. S. Emcient, completely adjustable syphon type spray gun complete with 12 ft. of 1060 lb. tested hose, only **$7.75** with pint container, also prepaid.

PORTABLE ELECTRIC DRILL TERRIFIC VALUE

Equipped with ¼" Jacobs Geared Chuck and Key

$19.95 **(Sold at less than established factory price so we cannot mention brand name)**

Not an intermittent duty drill, but a full size rugged tool. Most convenient type switch. Natural grip handle. Balance like a six shooter. Precision cut gears. Turbine type cooling blower. Extra long brushes. No stalling under heaviest pressure because of powerful 110 Volt AC or DC motor and multiple ball thrust bearing. Other bearings self-aligning life-time-lubricated Oilite type. Made for toughest year-in and year-out service in plant or on construction jobs. Amazing perpetual factory guarantee assures you of a lifetime of trouble-free use. Satisfaction guaranteed or money refunded if returned prepaid within 5 days.

LINE FILTERS

Type "A"—Each unit contains two 4 Mfd. oil filled condensers and a high inductance 20 Amp. choke in fully shielded case. Suitable heavy current connectors are provided to attach to the input and output connectors at each end of the filter from your input and output wires. A filter with innumerable uses on oil burners, refrigerators, boats, automobiles and wherever noise is to be suppressed or interference abolished. A $17.00 value for **$2.98**.

TYPE "B"—Heavy duty line filter consisting of 2 condensers and R. F. choke in plated steel case. Conservatively rated at 4 amps and 600 volts. Perfect for refrigerators, oil burners, power supply input of signal generators or to block out almost any interference you can think of. Super special **$.75** each or 10 for **$5.00**

ing there, and has been for four years; has programs three times a day in Spanish, Portuguese, and *English;* I hope to have further information on this one soon.

Guatemala—At the time this was compiled, a note had just been received from Leslie Garrison of TGNA, Guatemala City, stating that delay in getting the 11.850 outlet on the air was because of vacuum condensers; those

(*Continued on page* 153)

Recording Adapter

(*Continued from page* 65)

enough range for ordinary purposes. When recording, the tone control should be set for maximum high frequency response, and when playing back a recording, the operator should adjust the tone control for maximum bass boost. If the tape-pulling mechanism should be of the type which pulls the tape at 15 inches-per-second, practically no frequency compensation will be needed except some bass boost on playback.

Correct operation of the unit is achieved as follows: One output tube is removed from the amplifier and the plug-socket connector is inserted in its place. The tube is then inserted in the socket of this connector. The erase section of the head is connected to J_2 and the record-playback section is connected to J_1. A microphone is connected to the input plug of the amplifier and the switches should be turned to "Record" position. The plug P_1 is not inserted, but is left disconnected. A trial recording is then made so that the proper recording level can be determined. A few trials will show that the tape can be overloaded easily, and that good recordings can be made with a relatively low setting of the volume control. If the amplifier is equipped with a tone control it should be set to the "Treble" position.

After the tape has been rewound, the switches are turned to the "Play" position and the plug P_1 is inserted into the "Microphone" input of the amplifier in place of the microphone. The tone control is set for maximum bass boost. Although the high frequency bias voltage delivered by this oscillator is not critical, the operator should know that a signal which is deficient in high frequencies may have been recorded with too high a bias voltage. Conversely, a signal with high distortion and high background noise usually indicates insufficient bias voltage. The bias voltage can be adjusted by increasing or decreasing R_1 as before indicated.

Although the use of this adapter with an ordinary amplifier is not expected to achieve the results of a high quality amplifier made especially for magnetic recording, its use with a good amplifier will give results which may exceed those obtained with many of the lower priced magnetic recorders which are on the market at the present time. —30—

Defense Transceiver

(*Continued from page 43*)

with the r.f. chokes must be handmade. If the dimensions are followed closely the receiver and transmitter should be within the 220-225 mc. band. The author has a heterodyne frequency meter with which to spot the band. However you may use Lecher wires or if you have a television set with the standard 21 mc. i.f. then if you tune to Channel 11 the TV oscillator will radiate a weak carrier at 225 mc. If your receiver is too low in frequency and TV Channel 13 is used in your area, you should hear the sound from this station which is on 216 mc.

The antenna used with this receiver consists of a 25" length of ⅜" copper tubing the center of which is fastened to one end of a 1¼" square length of pole. This solid dipole is delta fed with a short length of 300 ohm TV line. The 300 ohm line is split back for 7 inches. One end of the wire is soldered 3 inches out from the center of the dipole while the other wire is soldered the same distance out on the other side of the dipole, thus forming a triangle. The 300 ohm line should be tied back tight along the wooden antenna support so that the delta match does not sway in the wind. If you expect to use a feed line longer than 25 feet do not use 300 ohm TV line as the losses will run too high. For long runs use two #18 wires spaced 1". Use lucite spreaders ¼" x ¼" x 1½" spaced every 12" along the line or purchase a similar low loss line manufactured by *Gonset Company*, Burbank, California. A 100 foot length of either of these feed lines causes only .5 db. loss at 200 mc. Vertical polarization is used on this band in the East.

The power supply is not described here but it should furnish 6.3 volts at 1.5 amperes for filaments and a maximum of 300 volts at 70 milliamperes d.c. for "B" supply. With the antenna and power supply connected, advance the regeneration control until the 955 detector goes into the usual hiss associated with superregeneration. If the antenna coil is too tightly coupled the detector will not operate smoothly. The regeneration control usually need not be advanced more than to feed 20 volts to the 955. Due to the split stator condenser the maximum dial spread can only be 90 degrees. The gain control not only adjusts the audio volume on the receiver but also the modulation level during transmission. Should the receiver not exactly cover the band the tank coil may have to be spread very slightly to go higher in frequency or compressed very slightly to go lower in frequency. At these frequencies it is essential to keep all your leads as short as possible.

After the receiver is functioning properly turn the switch from "Receive" to "Send." Next to the transmitter coil insert a two-turn coil wired to a brown bead 6-8 volt pilot lamp.

This lamp will burn bright if the 6J6 is oscillating. Now whistle into the microphone. If the light fluctuates with modulation undoubtedly the modulator is functioning properly. By using Lecher wires with the pilot lamp very loosely coupled you can determine the frequency. The other methods mentioned can also be used to put the transmitter on frequency. If the rotor plates of the butterfly condenser are about ⅓ meshed with the stators you will be fairly close to the center of the band.

A number of two-way tests have been made over a 17 mile path from home QTH's with this station and the signals were about R3, S3. While this type of communication is not within the design requirements of this station it is mentioned only to put at ease those doubting souls who can't believe 2 watts of carrier is sufficient for consistent 5 mile communications.

—30—

NEW CERAMIC TUBE

THE first commercial ceramic tube ever made, capable of operating up to 900 mc. at 1 kw. output, was recently introduced by General Electric Company's Tube Divisions at the IRE Convention in New York.

The new tube, the Type GL-6019, was designed primarily for u.h.f. television transmitter service.

The all-ceramic and metal power tube is capable of operating up to and beyond the top frequency (890 mc.) of the proposed u.h.f. television channels. The use of ceramic in the new tube minimizes the problem of high frequency losses and makes envelope cooling problems less difficult than with glass tubes.

The new tube has several other features. A gold-over-silver plating on all external metal parts provides low-loss electrical contacts. The concentric ring-seal construction enables the tube to be easily inserted or removed from its cavity. Water pipes are so arranged that connections can be made outside the r.f. cavity.

Maximum ratings of the GL-6019 at synchronizing level for class B television service include: d.c. plate voltage, 4000 volts; d.c. screen voltage, 600 volts; d.c. plate current, 700 ma.; plate input, 2.5 kw.; and plate dissipation, 2 kw. —30—

General Electric's new ceramic tube which is designed to operate up to 900 mc. at 1 kw. output. The Type GL-6019 was designed for u.h.f. television transmitter use.

the Commission reported that in all communities having three or more assignments (very-high or ultra-high), one channel for educational work had been reserved. In those communities with fewer than three assignments, no reservation had been made, except in places which are primarily educational centers, where reservations were spotted even where only one or two channels were assigned.

The educational allotment did not strike Madam Commissioner Frieda Hennock as adequate, and in a lengthy dissent, she said that . . . "failing to give the schools a sufficient share of the remaining television spectrum, will adversely affect the course of education in the United States for generations to come." She felt that the reservation of approximately ten per-cent of the total assignments . . ." has failed to provide facilities for education in a large number of cities of substantial size. . . . Thus, there is no frequency reserved in more than one-fourth of the one-hundred and sixty-eight standard metropolitan areas. . . . The Commission's proposal for many of our largest cities, such as New York, Los Angeles . . . confines the reservation to the ultra-high band, and makes no provisions for educational broadcasting in the very-high frequency band now in use."

In a caustic commentary on the immediate future of higher-band operation Miss Hennock declared that up to now ultra-high work has been purely experimental and . . . "we have no assurance as to when ultra-high equipment will be available and ultra-high stations in operation." Pointing out that in each of the larger cities, there are at least three or more standard-band stations in operation, and that only through extensive conversions to the millions of sets now in operation will it be possible to receive the new high-band stations, Miss Hennock declared that the audience prospects for the higher bands are quite remote.

"In these circumstances," cites Madam Commissioner, "the Commission quite properly indicates concern that even commercial interests in the ultra-high bands will be required to face substantial economic problems, beyond those ordinarily faced by a very-high operation. . . . How then, can the Commission, consonant with practical realities of the situation, force educators in these localities to carry the additional burden of ultra-high operations, which they are clearly ill-equipped to do?"

A blistering dissent, issued by Commissioner George Sterling, declared in part that . . . "It would seem to me that it is in the public interest to make available the greatest number of very-high channels at the earliest date possible so as to provide increased com-

petition in several markets and make available service to the public in those areas of the country that have been denied a television service, because of the color issue and the freeze. . . . Industry is prepared immediately to build stations in the very-high band, a limited amount of transmitting equipment is available, and receivers for this band at this band are not in short supply."

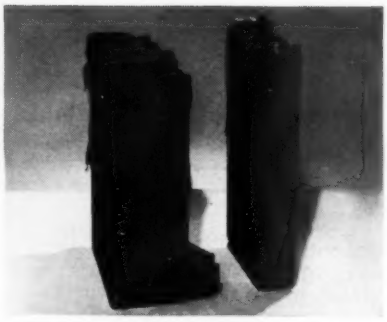
FCC Headman Coy, in a supplementary review of the educational aspect of the proposals, said that there is a startling lack of data concerning the willingness and readiness of educational institutions to use television as a tool. In his opinion, educational institutions will have to make up their minds in the reasonably near future . . . "as to whether or not they will utilize television in their educational program, and in so doing decide to become an operator or a joint operator of a non-commercial educational television station."

As this column is being written hundreds are preparing to testify for or against the allocation proposal, in a seething series of sessions. However, notwithstanding the rough program ahead with many scheduled to hammer away at the recommendations, a workable pattern will certainly present itself, with harmony on the look-and-hear lanes the theme of the plan.

INDUSTRY'S ROLE IN COLOR TV, on trial in the Supreme Court and for nearly a year a probe pet of Washington's seven airwave sheriffs, saw itself headlined, too, at the recent annual convention of the IRE in New York City, particularly during a rousing talk by RTMA's board chairman, Robert Sprague.

Stoutly defending the chassis makers, and especially the engineering fraternity, Sprague said: "I don't think that it is necessary for me or anyone else to come to the defense of the industry's engineers. Their record for more than a quarter of a century speaks for itself. However, I would like to take this opportunity to deny categorically the charges which have been hurled at our industry. . . . Engineers are highly individualistic persons who often do not agree with each other or their commercial colleagues. They are influenced in their decisions by facts and figures, and not by pressure from whatever source. . . . Our industry engineers generally strive to offer to the public the fruits of their technological developments at the lowest possible cost, but they seek to avoid foisting on the public either systems or equipment which have not been thoroughly tested."

Lashing out at FCC Commissioner Robert Jones, who in his color report rebuked industry and engineers calling them "unsound analysts," whose testimony was . . . "completely worthless"—because . . . "their economic interests blinded their engineering judgment" . . . Sprague said: "It is true that engineers are sometimes brutally frank in expressing opinions, whether they speak as individuals or representatives of industry or engineering groups, but I think that any fair-minded person would concede that they are honest and fair in their ultimate judgments."



Comparison in size between the World War II walkie-talkie (left) and the new AN/PRC-10 model developed by RCA. The new unit is approximately half the size of the older unit and has greater coverage.

Describing the exhaustive efforts of industry to provide honest and sincere answers to problems, Sprague recalled the days of the first national television committee, formed as the result of a meeting between former FCC Chairman James Fly and Dr. W. R. G. Baker, director of engineering of RTMA and formerly prexy of the IRE. "The monumental work of that committee is a matter of record," declared Sprague, who added that in six months the committee developed standards and reported to the FCC.

Over 600,000 words were prepared for reports and 4000 man-hours devoted to meetings and an equal time to travel, the association head pointed out. As a result of this work, the standards for black and white television were proposed and television was off to a successful start.

"Perhaps the best measure of this almost unparalleled example of cooperation among engineers," reported Sprague, "is that several foreign countries have adopted television standards based upon those of the United States, with only minor variations."

Commenting on the color issues now being debated, Sprague declared that: "Much has been made of the fact that four of the NTSC committees were overwhelmingly in favor of color television as demonstrated by the *CBS* system. Overlooked, or at least under emphasized, are some of the other opinions expressed by these engineers at the same time. By substantial majorities, these engineers voted against adoption of color standards at that time, and expressed the belief that black and white standards should not be influenced by color television considerations."

The RTMA official's talk also disclosed the progress being achieved in the mobilization program. According to Sprague, military electronics production will reach a peak rate of $2.5 billion in the fall of 1952 and there-

after will decline to an annual rate of $1.5 billion. "In this connection," he said, "it should be borne in mind that military production dollars have about half the impact on our industry as civilian production dollars. This is for a variety of reasons, but particularly because a considerable portion of special and mechanical gear is obtained from manufacturers not generally considered as part of our industry. . . . These figures indicate that our industry will not be so heavily loaded with military contracts, but that it will be able to maintain a substantial amount of civilian production, even at the peak of the military output, except in the unfortunate event of an all-out war."

THE "DO" RATINGS, a priority term set up to assure speedy delivery to the armed services, have also become a true friend of the radio and TV part users. With *DO-97* assigned to equipment and supplies for maintenance, repair and operation, there should be available a flow of the vital items necessary to keep those sets going.

Describing the new plan, Manly Fleischmann, administrator of the National Production Authority, said: "We cannot let the need for materials and equipment to build new facilities interfere with the maintenance of existing capacity. We can afford a few pounds of metal today to keep a machine running rather than several tons tomorrow to make a replacement machine. And in this way, we can avoid the loss of production and equipment that would result if we allowed our present equipment to fall into disrepair . . ."

Pointing out that it is imperative that the country's present production and service facilities be kept in good repair, Fleischmann said that it is . . . "vital that we maintain a strong civilian economy while we go ahead with the job of rearmament. . . . It is believed that the *MRO* (maintenance, repair, and operation) program will not interfere in any manner with the defense program, because the materials required constitute but a small percentage of the total supply."

A NEW INFANTRY VERSION OF THE WALKIE-TALKIE, one-half the size and weight and with twice the range of those used in World War II, demonstrated recently before members of the Signal Corps and other government agencies, will soon be on the way to our troops in Korea. Describing the production of the gear as a milestone in military communications, Major-General S. B. Aiken, Chief Signal Officer, said that the transmitter-receiver will help meet the problems of modern warfare and make it possible for the armored divisions, artillery, and infantry to keep in constant touch with each other, from point to point, even all the way back to the Pentagon, if that is necessary. . . . . L.W.

What's New in Radio

(*Continued from page 80*)

new unit is called the "Civil Defender."

Designed to be used by police agencies, fire departments, water departments, the Red Cross, highway maintenance departments, power companies, and other groups comprising the civil defense organization, the new receiver permits civil defense headquarters to broadcast messages to all groups at once or to separate groups individually. Thus a group hears only messages it is intended to receive. Each receiver is inactive until turned on by headquarters.

In addition to receiving messages, the unit can also be used to automatically start and stop air raid sirens or other warning devices. The push of a button at headquarters broadcasts a special tone which, when received by the set, operates a switch to activate the warning device system.

Full details on the new receiver are available from the company.

COMPACT SCOPE

The Simpson Electric Company of 5200 W. Kinzie Street, Chicago, Illinois is currently in production on a new model oscilloscope which is designed to save space on the test bench.

Designated the Model 476 "Mirroscope," the new unit uses a 5" cathode-ray tube mounted in a vertical position. This type of construction reduces bench requirements to an area of 9" x 8". The cathode-ray image is reflected from a mirror mounted in the adjustable cover at the top of the cabinet. In this way the viewing surface is brought near the eye level when the instrument is used on benches of normal height. The mirror and wing sides at the top for deflecting light fold into the cabinet when not in use.

A high frequency crystal probe is available for use with this scope at an additional charge.

NEW TUBE CAP

Alden Products Company of 117 N. Main Street, Brockton, Massachusetts has announced a new high voltage, low-loss tube cap for use in miniature tube applications.

The tube cap in which the wire insulation and long skirted grid cap insulation is molded in polyethylene as one homogeneous unit, is designed to be used with a 1X2 tube or tubes of

similar physical dimensions. The 90 ISTL unit has a long skirt that prevents danger of flashover from grid cap to chassis when operated at high voltages. The wire and grid cap molded as one unit gives positive strain relief of leads against vibration, twisting or strain and gives 100% insulation.

For critical operations at extremely high temperatures the 90 ISTL can be molded in "Kel-F."

Complete details are available from the company. Address your requests to the attention of Norman Curtis.

SUBMINIATURE CONDENSERS

Sprague Electric Company of North Adams, Massachusetts has developed a complete line of subminiature condensers and a new technique for mounting such units.

The new 125 degree C units are available as hermetically-sealed, tiny threaded-neck, side-stud and end-stud condensers as well as in vertical and horizontal bracket mounting units. These new mounting arrangements are designed to help overcome vibration and shock problems encountered when mounting condensers by wire leads in military gear.

The units are available in voltage ratings from 100 to 1000 volts d.c. in both inserted tab and extended foil constructions.

Engineering details on the new condensers are contained in the company's Bulletin 213A which is available to those making the request on their company letterheads.

BASS REFLEX CABINET

Standard Wood Products Corp., 43-02 38th Street, Long Island City 4, New York has a new model bass reflex cabinet available for 15" and 12" speakers.

The Model RX combines the latest acoustic engineering principles with authentic furniture styling. The cabinets feature wide frequency response, high power handling capacity, and wide angle distribution.

Construction throughout is non-vibratory. Interior acoustic padding

eliminates all internal sound reflections. Capacity of the unit is 10,000 cubic inches and the plywood baffle and back are easily removable. The baffleboard is cut out for 15" or 12" speakers

and is already mounted and equipped with speaker mounting bolts. To vary the size of the port opening, the baffleboard is adjustable.

The cabinet is available in mahogany, cordovan mahogany, walnut, ebony, and blonde finishes and measures 36" high, 16" deep, and 24" wide.

TURNER MIKE

The *Turner Company* of 900 17th Street, N.E., Cedar Rapids, Iowa, is now in production on a new crystal microphone, the "Competitor."

Catalogued as the Model 60X, the new unit is designed for hams, economical p.a. and sound systems, and other applications where good speech reproduction is required and cost is a factor.

The mike is housed in an attractive case finished in baked-on beige wrinkle finish enamel and comes complete with a six-foot cable and stand adapter.

Response is 70 to 7000 c.p.s. with a level of 52 db. below 1 volt/dyne/sq.

cm. The crystal is moisture sealed. The unit is available with an "on-off" slide switch.

Full details are available on request.

PRECISION POT

In response to the growing demand for precision-built parts for use in critical electronic assemblies, *Clarostat Mfg. Co., Inc.* of Dover, New Hampshire has announced the development of a special precision potentiometer for such applications.

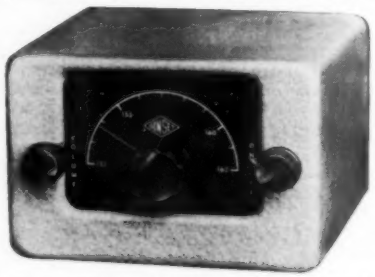
The new control, which is being produced on a custom basis, has a tapered winding held to a tolerance of ±1½% linearity as measured at ten test points. Mechanical tolerances are held as close as ±.00025 inch. Designed to operate over extreme ranges of temperature, humidity, altitude or barometric pressure and under severe vibration, the new component is also treated to meet fungus and corrosive conditions.

The body of this special control is molded in yellow or low-loss bakelite. Positive low-loss conductivity is assured by the silver contact carried by the ring-shaped slider which rides the winding as well as the contact rail. A slip-on black plastic cap protects the control mechanism.

FM TUNER

The Gonset Company of Burbank, California has just announced a new FM communications tuner designed for ultra-high frequency reception.

The tuner is available in several frequency ranges and is especially suited



for reception of police, fire, taxicab, aircraft, civilian defense, and other such services. Among the frequency ranges available are 152-162 mc.

The entire unit is housed in a compact box which measures 5¼" x 3½" x 5¼".

A descriptive bulletin on the new unit is available from the company.

HANDY NEW TOOL

Drilsaw Co. of 1561 Virginia Avenue, Glendale 2, California has introduced a new combination drill and saw unit which is unique in design and applicable to many jobs in the radio or television service shop.

The blade is made of steel and is set immovably in a lacquered hardwood handle. The tip of the blade is a fast boring gimlet. The main portion of the blade is sharply toothed spirally so that the tool saws rapidly in any direction after drilling its own hole.

The tool will handle plywood, hardwood, plaster, and wallboards and is especially useful in cutting regular and irregular holes for receptacles, switch boxes, etc.

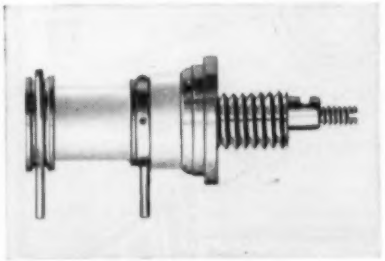
Complete details and prices are available from the company.

SLUG-TUNED COIL FORM

Cambridge Thermionic Corporation, 463 Concord Avenue, Cambridge 38, Massachusetts is currently offering a

new slug-tuned coil form that features silver plated phosphor bronze clip terminals which cannot loosen.

The Type LS-8 measures 23/32" high, and ½" maximum diameter. The unit mounts in a "D" punched hole or in a ¼" round hole. The coil form is made of grade L-5 silicone impregnated ceramic. The slug is provided with a spring lock. All metallic parts except the clips are cadmium plated to insure long-life service.



The LS-8 comes complete with slug and all of the necessary mounting hardware.

MOBILE RADIOTELEPHONE

The *Kaar Engineering Company*, Middlefield Road, Palo Alto, California has recently announced the availability of a new single unit transmitter-receiver for mobile communication in the 152-174 mc. band. The new model has been tradenamed the "Radiopak."

The new unit is completely integrated for simplicity of installation, maintenance, and operation and features improved stability and sensitivity while its engineered selectivity exceeds the standards set by FCC regulations.

Power output of the new unit is 10-12 watts with a battery drain of 6½ amperes during standby periods and 15 amperes during transmission. The equipment will operate from the regular 6 volt vehicular electrical system. Overall measurements are 6¾" high, 8" wide, and 18⅛" long. The unit weighs 24 lbs. including the dust cover.

Complete technical data on the "Radiopak" is available from the company.

-30-

Naval Communications

(*Continued from page* 38)

Centers. Over one-half of the installations already are operative. The equipment furnished is the same as that employed in the Naval Communication Service. It is equivalent to the best to be found in either military or commercial establishments. Teletype training is of two types—operational and rate training for communication personnel, technical training for maintenance personnel. Radiomen are responsible for the operation, repair, and operational maintenance of the basic teletype equipment. Electronics technicians are responsible for maintenance and repair of the electronics components.

The technical instruction includes all aspects of teletype communication equipment, both landline and radio. Operational training covers the general field, from the relatively simple reception of teletype broadcasts and "press-to-type" automatics such as are used on v.h.f. and u.h.f. circuits, to the more complex communication-center type of operation which involves automatic tape relay and other advanced techniques.

In addition to the complete units described, each Training Center has two teletype machines, which may be operated within the Center for operational and maintenance training. Many activities have constructed auxiliary equipment which permits the use of these machines on live radio circuits. Radioteletype training circuits are included in the Reserve Communication Networks of several Naval Districts.

The "CIC"

To provide practical training in one of the most important phases of Naval operations, major Combat Information Center (CIC) installations have been made at selected Naval Reserve Training Centers and Naval Air Stations. Geographical and personnel considerations govern the selection of activities for major installations. Some of these are complete CIC's as found on fighting ships, and like those aboard ship have presentations for the display of radar information, for controlling aircraft, and for assisting in the surface problem. They make possible advanced training of officers and men, working together as a coordinated team. Exercises are conducted in tracking and plotting actual radar targets and in controlling aircraft in flight. When "live" targets are not available, simulated exercises are introduced by means of electronic problem generators. Basic CIC installations are provided at all Naval Reserve Training Centers not designated as advanced CIC training points. All of the reserve CIC's have enough equipment to enable Reservists to practice the fundamental tactical problems which they may later encounter aboard ship.

Certain outstanding Electronics Fa-

cilities are furnished various types of radar equipment, including search radars, to permit technical and operational training.

ASW

As in the case of CIC, certain Naval Reserve Training Centers have been designated as major Anti-Submarine Warfare (ASW) training locations. These activities have been furnished with the latest type electronic equipment used in undersea warfare, plus suitable training aids. Target simulators also have been provided for both individual and team training. Other Training Centers have been equipped for basic ASW training. Although the equipment is not as complete or elaborate as that furnished to the major ASW training centers, it is sufficient to provide individual training in the fundamentals of sonar.

Inter-Service Training

Members of Reserve components of the Army, Air Force, Marine Corps, and Coast Guard may be authorized to attend drills with units of the Naval Reserve, under certain conditions. Similarly, members of the Naval Reserve may be authorized to attend drills with units of Reserve components of the Army, Air Force, and Marine Corps. In both cases, interservice training is confined to personnel on a non-pay status and is authorized only when appropriate training with a Reserve unit of the individual's own service is not reasonably available.

Where individual members of Reserve units of the Army, Air Force, Marine Corps, or Coast Guard are authorized to train with the Naval Reserve, they are integrated into Naval Reserve Training groups appropriate to their ratings or classifications and receive Navy instruction and supervision. In some cases, complete Reserve units of the other services are authorized to use Naval Reserve facilities, furnishing their own instructors and supervisors for classes and drills.

Emergency Communications

Although the primary purpose of the Naval Reserve Communication System is to provide training, the potentialities of Naval Reserve radio circuits for service in disasters and emergencies have been written into District Reserve Communication Plans. Provision is made for the integration of the Reserve System into the Naval Communication Service as necessary. At the local level, emergency planning by each Naval Reserve activity includes acquainting civic authorities, the Red Cross, radio amateurs, and all interested agencies with the facilities available for emergency communication service.

Not only are Naval Reserve radio stations equipped with portable transmitters and receivers and emergency power, but mobile communication vans are available within each Naval District for dispatch to stricken areas as

needed. Naval Reservists have a long and proud record of emergency communication service to their communities in time of floods, storms, fires, and other disasters when normal communication service is disrupted.

Amateur Radio

Naval Reservists are encouraged to obtain amateur radio licenses and to participate fully in amateur radio activities. Naval Reserve units with which licensed amateurs are associated are urged to apply for amateur licenses and to engage in amateur operation outside normal Reserve training periods. There are over 500 amateur stations in operation at Naval Reserve Training Centers, Electronics Facilities, and Electronics Stations. They are recognized on the air by special call signs assigned by the Federal Communications Commission. These calls are assigned from the blocks K1NAA through KØNZZ; K1USN, K2USN, etc., through KØUSN; and W1USN, W2USN, etc., through WØUSN. Distinctive QSL cards, authorized for amateur stations at Naval Reserve activities, will be found on the walls of many ham shacks.

Amateur radio organizations are encouraged to make use of the amateur stations at Naval Reserve activities as meeting places. Numerous ham clubs take advantage of this arrangement. Cooperative effort is then possible between Naval Reserve units and local amateurs in the conduct of classes in radio code and theory for prospective licensees. Close liaison also is maintained between radio amateurs and Reserve units in emergency communications planning and practice. Emergency exercises in which many Reservists participate include particularly the annual Field Days and Simulated Emergency Tests conducted by the American Radio Relay League.

Individual Hams

Any member of the Naval Reserve, Marine Corps Reserve, or Coast Guard Reserve who is an FCC-licensed radio amateur, and any amateur in the Regular Navy, Marine Corps, or Coast Guard, may, upon request, be authorized to participate in Naval Reserve radio drills from his home station. Naval Reserve call sign and frequency are assigned to the individual amateur for this purpose. His station is designated a "Naval Reserve Radio Station" and an appropriate certificate of authorization is issued. Many amateurs participate in the Electronics Program, both as members of Electronics units and as members of special individual-amateur radio training circuits. Not only does operation on these circuits enable them to obtain additional training in Navy communication procedures, but their stations become part of the Naval Reserve Communication System for emergency communications purposes. More than 1000 radio amateurs have received authorization to participate in Naval Reserve networks.

In recognition of the skill represented by an amateur radio operator license, individuals who hold such licenses are given special consideration for rapid advancement in the Naval Reserve when they are associated with Volunteer Electronics units. Class A and B amateur licensees may be advanced to Radioman 3rd Class as soon as qualified. No time-in-grade requirement is stipulated. Holders of Class C amateur licenses are rated Seaman Apprentice immediately upon enrolling in a Volunteer Electronics unit, and advancement to Seaman is authorized as soon as qualified. In the case of commercial operators, holders of Commercial Radiotelegraph 1st and 2nd Class licenses may be rated Radioman 2nd Class when qualified, with no time-in-grade requirement. Those who hold Radiotelegraph 3rd Class Operator Permit may similarly be rated Radioman 3rd Class, if associated with a Volunteer Electronics unit.

An Invitation

The Naval Reserve Electronics Program provides for the individual member an unusual combination of training and self-improvement. As in any field, of course, the return to the individual is proportionate to his interest and effort. The Program has so many diversified aspects that appeal exists for practically all electronics and communications enthusiasts, whatever their sphere of interest. It is worthy of note that a fine spirit of good fellowship exists between officers and enlisted personnel of the Electronics Program. Although appropriate discipline and courtesies prevail as in any military organization, the mutual interest in electronics on the part of officers and men creates an exemplary *esprit de corps.* Officers work shoulder-to-shoulder with enlisted personnel toward a common objective—to be trained and ready for service to the nation when needed. Members of the Naval Reserve performed feats which wrote glorious chapters in the history of World War II. The defense of the nation is dependent upon strong military Reserve forces. The rapid advance of the combined sciences of communications-electronics points up the importance of a strong Electronics Program. The Naval Reserve extends a standing invitation to all persons to participate in the Naval Reserve Electronics Program as regular members, volunteer instructors, advisers, or in any way their talents and experience may best contribute.

Officers-in-charge of Naval Reserve Training Centers and commanding officers of all Naval Reserve units can advise how you can best participate in these interesting and profitable activities. Visit the Naval Reserve activity nearest you and learn first-hand the many opportunities that membership in the Reserve will make available to you. If there is no Reserve activity in your area, further inquiry can be addressed to the commandant of your Naval District. —30—

TV Close-up
(*Continued from page* 39)

is the director's determination of what he is going to send out over the air that makes the final program either a fulfilment of 125 people's dreams—or disappointment.

There are a number of technical tricks at the director's disposal which he can use to give the show "that certain something."

He may pan. This means that the camera follows the action as the performers move.

He may dissolve. In this case, the picture of one camera is slowly brought in over the picture of another camera, with the picture on the second camera being withdrawn. This is a technique that is used to achieve the flow from number to number on the Vaughn Monroe Show.

He may do super-imposition. In this instance the pictures being recorded by two television cameras are sent out over the air simultaneously. The effect is similar to what you get when you forget to turn the film in your "Brownie" except that, on television, we try to plan it. In this way, it can be made to appear as though a tiny Shaye Cogan is in a frappé glass in front of a life-size Vaughn Monroe, or that rain is pelting down on a set that is actually bone dry.

And he can cut. This is purely a matter of switching from the picture on one camera to the picture on another.

There is little else he can do. His tricks are largely limited to those, so that what finally counts is not the tricks at all, but the charm of the performers and the brilliance with which the director can first imagine, then stage, the production he will photograph.

This is why those monitors are such uncompromising critics of the ability of the men who sit in the control rooms and provide us with our television entertainment.

—30—

Compact Ham Rig

(*Continued from page* 59)

is exactly 12 inches long. The connection to the transmitter is made with a good grade of weather-insulated lead-in such as "twin-lead." Use the 75 ohm impedance line.

Slit the twin-lead between the two leads for a length of about 13 inches. Bare the ends of the leads and solder them securely to the ends of the antenna doublet where the splice has been made. Fan the twin-lead leader for 12 inches.

Connect the free ends of the twin-lead lead-in to the *Eby* binding posts at the rear of the transmitter chassis. Ordinary twisted-pair lead-in, such as is used with short-wave receiver doublets, can be used in the same manner as the twin-lead. If it is used, some losses may be experienced at the high end of 40 meters and it will soon decay with the ravages of weather. The rig will work out well on 160, 80, and 40 meters.

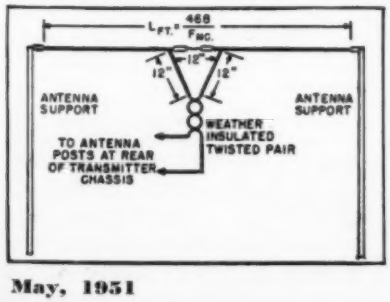
Connect a meter with a 75 or 100 milliampere full scale reading to a phone plug and insert it into the "*Key*" jack. With the proper crystal, the coil, and the 6V6GT tube in their sockets, plug the power cord into the wall outlet. In about 10 seconds, the tube will have heated and the meter will give a reading. If the meter needle has moved to the left instead of to the right, simply reverse its connections to the phone plug. The meter will read correctly now. The tuning light will glow and assist in tuning up.

Rotate the tuning knob and you will find a point where the meter needle dips. Simultaneously, the tuning indicator lamp will go dim. The points of maximum meter needle dip and minimum lamp brilliance indicates resonance, the point of tuning where good transfer of transmitter power to the antenna takes place. The meter should read between 40 and 50 milliamperes. Replace the meter with your key and you can go on the air.

Antenna For Two Bands

There is another simple antenna that works quite well if your shack is

Fig. 4. Details of the half-wave doublet antenna which is suitable for single-band operation. The formula for determining the correct antenna length is included in the text. The antenna can be used on 160, 80, or 40 meters by substituting the correct crystal frequency in the given formula.



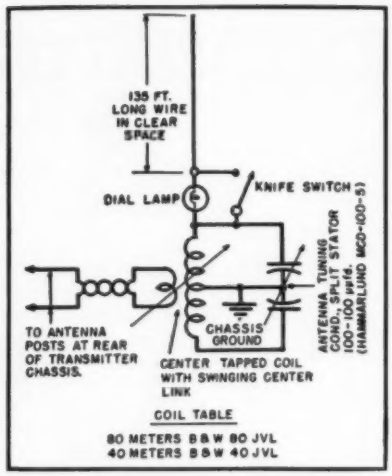


Fig. 5. Construction details on an end-fed half-wave-at-80-meter antenna. This comparatively simple antenna works quite well in cases where it is possible to run a long wire. It gives fair results at both 80 and 40 meters providing the antenna is erected in the clear. It is not particularly directional, although surrounding structures may cause it to exhibit some directional characteristics. On 40 meters the antenna produces some low-angle radiation which is advantageous in DX work.

near the roof and you have plenty of space to run a long wire. It is the end-fed half-wave-at-80-meters type. It gives fair results at both 80 and 40 meters, if erected reasonably in the clear. This antenna is not particularly directional, although surrounding structures might cause it to exhibit some directional characteristics. On 40 meters, the antenna produces some low angle radiation which is an advantage in working DX. The antenna is shown in Fig. 5. As you see, it requires an additional tuning circuit. The coil is a standard commercial coil that can be obtained at all radio parts houses. The actual tuning is just a little more complex than with the doublet type of antenna.

The antenna should measure 135 feet from its far end to the antenna terminal at the transmitter.

Tuning the End-Fed Antenna

Connect a meter and plug into the *"Key"* jack as described before. Open the knife switch shown in Fig. 5. The proper crystal, coils, and 6V6GT tube should be inserted into their sockets. With the power turned on and the tube heated, rotate the tuning knob on the transmitter chassis until a dip in the meter reading, resonance, is found. Again, this reading coincides with a minimum glow of the tuning indicator lamp. Rotate the antenna tuning condenser, Fig. 5, until the dial light in series with the antenna glows brightest. Now, close the knife switch. This shorts out the dial lamp. Readjust the transmitter tuning condenser for resonance. You will notice that the meter now gives a new and higher reading at resonance. This is normal now that the antenna is coming into

tune with the transmitter. The center link on the antenna coil is adjustable, simply by bending it in or out of parallel with the side windings. This is useful in adjusting the quality of your signal consistent with good power output. If the coupling is too tight, the oscillator may be erratic or even refuse to operate, or your signal may sound "chirpy." Then again, too loose coupling will not allow full power to be transferred from the transmitter to the antenna.

If the dial lamp in the antenna lead does not give sufficient indication to be observed, substitute a 2 volt 60 milliampere lamp. In operation, the knife switch should be closed after the tuning procedure has been completed and the meter has been replaced with a key. The rig is so small that it can be placed on the night table of the guy who says to his wife, "Just one more QSO before I go to bed, dear." -30-

TUBE SUBSTITUTE

By NORRIS HEKIMIAN

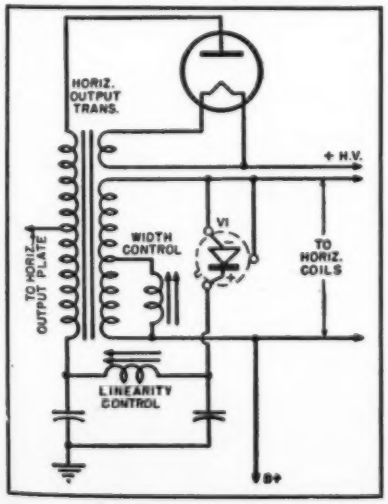
NOW THAT it is becoming more and more difficult to find replacement tubes for television sets, one substitute has evolved which has proven fairly useful.

It is possible to substitute selenium rectifiers for horizontal deflection damper tubes in television receivers. By using a 150 ma. selenium rectifier rated at 350 volts peak inverse voltage in place of the damper tube, one of my substitution problems has been solved.

All that is necessary is to either wire the selenium rectifier into an old tube base or simply solder two one-inch lengths of No. 12 wire to the unit and insert it in the damper tube socket as shown in the diagram of Fig. 1.

While there is some reduction in deflection efficiency due to the lower back resistance of the selenium rectifier as compared to the vacuum tube rectifier, the loss is slight. The increased ruggedness and cooler operation, together with the surge current capabilities, compensate for the loss and, after all, the set does work! -30-

Fig. 1. Method for substituting a selenium rectifier for horizontal damper tube.



Resistance Welding

(*Continued from page* 52)

carrying ability. The tube must be capable of carrying the full primary current of the welding transformer. Vacuum tubes are immediately disqualified since their current ratings are measured in milliamperes. The gas-filled triode (thyratron) is next in the sequence of considerations, but its current rating rarely exceeds 10 or 15 amperes, insufficient for this application. The current carrying capacity of the thyratron is limited by the fact that, in operation, its cathode is bombarded by positive ions of gas. The current is thus limited by the threat of cathode disintegration. If a pool of liquid mercury is used as a cathode, it will not be damaged by ionic bombardment and the tube will safely carry hundreds, even thousands, of amperes. The *ignitron* is a liquid cathode tube of this type.

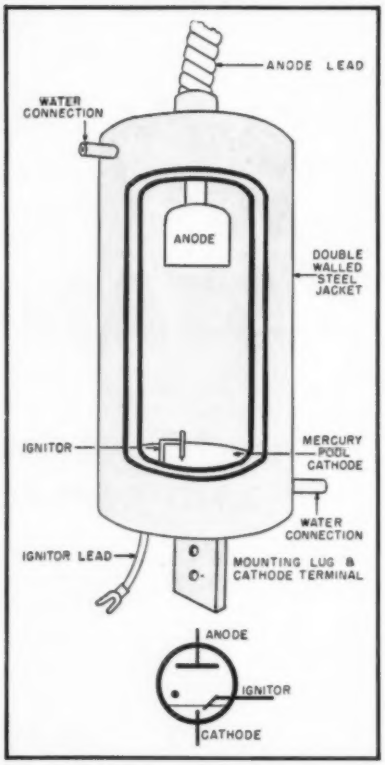


Fig. 2. The ignitron. The pool of mercury is an almost indestructible cathode and the tube can thus carry thousands of amperes.

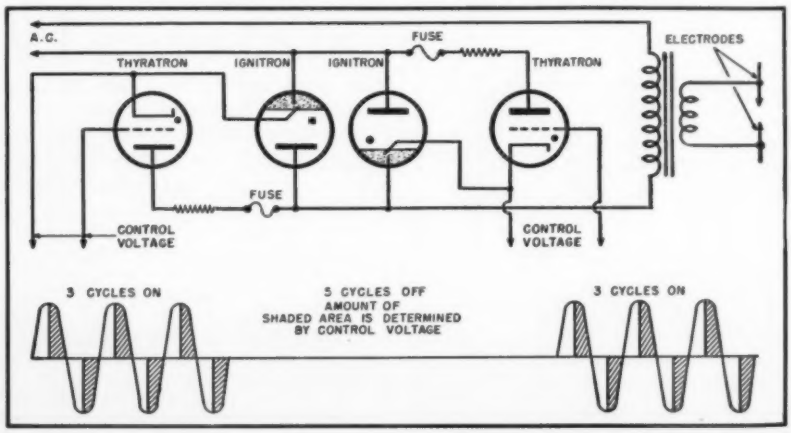
Fig. 2 illustrates the construction of the ignitron. The pool of mercury in the bottom of the tube serves as the cathode. The anode is made of graphite and is located at the other end of the tube. Graphite is used because it is a good radiator of heat and also because it does not emit electrons when operated within its ratings. This feature prevents back-conduction through the tube. The envelope of the tube consists of a double-walled, steel jacket. Water is circulated through the space between these walls for cooling.

The ignitron is a cold-cathode tube. A starting electrode, the ignitor, is therefore used to initiate current flow. The ignitor is pointed piece of silicon carbide or similar hard substance and is in contact with the mercury cathode. When a voltage is applied between the ignitor and the cathode, a spark occurs at the junction of these two elements. This spark vaporizes and ionizes a quantity of mercury, after which current flows to the anode.

Back-to-Back Circuit

Fig. 3 shows a representative diagram of a welding circuit. The two ignitrons are connected "back-to-back" so that one will conduct on the positive alternations and the other on the negative. In this way, alternating current flows in the circuit even though two half-wave tubes are used. Rectification is neither necessary nor desirable in this application. The ignitrons are used as a heavy duty switch to turn the welding current on and off at the desired rate. Two thyratrons are used in the circuit, one in series with the ignitor of each ignitron. With this arrangement, each ignitron will fire when its associated thyratron is fired. Since firing of the thyratron can be delayed through any portion of the posi-

Fig. 3. The back-to-back circuit and the typical "on-off" sequence.



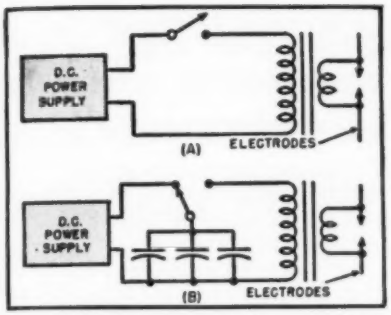


Fig. 4. (A) Magnetic energy storage welding. When switch is closed, current from d.c. supply establishes magnetic field in transformer. When switch is opened, magnetic field collapses and induces current in secondary. (B) Condenser type of energy storage welding. When switch is thrown to left, condensers charge from d.c. supply. When switch is thrown to right, they discharge through transformer and weld is made.

tive alternation, the average current carried by the ignitrons can be easily controlled. The sequence of current flow is illustrated in Fig. 3. The circuit is alternately turned on and off for three cycles of heat time and five cycles of cool time. The shaded areas indicate the times during which the ignitrons are conductive. This amount of shaded area is controlled by the voltage applied to the grids of the thyratrons. Either magnitude or phase control may be used. The shaded area, and therefore the average current and the heat developed in the work, can be easily controlled and adjusted to suit the requirements of individual jobs.

Energy Storage Welding

As suggested by its name, energy storage welding involves a period of time during which energy is stored, followed by an interval in which the stored energy is released to produce the weld. The energy may be stored either in a magnetic field or in a bank of condensers. Fig. 4A illustrates the magnetic energy storage system. With the switch closed, the d.c. power supply passes a current through the primary of the welding transformer. A high inductance primary is used so that an intense magnetic field will be established. To produce the weld, the switch is opened. With the opening of the switch, the magnetic field will collapse. This collapsing field cuts across the secondary and induces the voltage and current to produce the weld.

Fig. 4B illustrates the condenser type of energy storage welding. The switch is first thrown to the left to allow the condensers to charge from the d.c. supply. When the switch is thrown to the right, the condensers discharge through the transformer, producing the weld.

The technique of resistance welding has contributed immeasurably to the improvement of many of the metal products which play a vital role in our everyday lives—products that we buy directly and products which serve to improve our standard of living.

-30-

NEW TV PRODUCTS

DISC CONDENSERS

Cornell-Dubilier Electric Corporation of South Plainfield, New Jersey has recently announced a new series of miniature ceramic disc condensers for bypass and coupling in TV, FM, u.h.f. and v.h.f. in compact, miniaturized equipment.

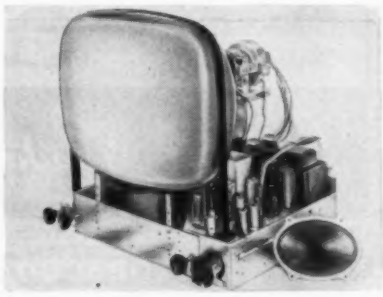
Known as the "Tiny Mike" series, the new units are available in five basic types. The Type 2 TM is ¼" in diameter and is available in single capacity units from 500 to 1000 $\mu\mu$fd. at 500 v. Information on these condensers is contained in the company's Bulletin No. 2-610. The Type 6 TM is 19/32 inch in diameter as single capacity units from 50 to 5000 $\mu\mu$fd. at 500 v. Bulletin No. 2-611 covers these units.

The Type 8 TM is ¾" in diameter and has a capacity rating of 10,000 $\mu\mu$fd. (8TM5S1C) at 500 v. Bulletin No. 2-612 carries data on these units. The Type 6 TM dual capacity units (from 2 x 100 to 2 x 2500 $\mu\mu$fd.) measure 19/32" in diameter. The Type 8 TM dual capacity unit (from 2 x 3000 to 2 x 10,000 $\mu\mu$fd.) measures ¾" in diameter. The last two types are described in Bulletin No. 2-613.

ADVANCED TV KIT

Tech-Master Products Company, 443 Broadway, New York 13, New York has recently introduced a new television kit which incorporates several unique features.

The basic Type 630 circuit has been improved and the new kit offers a



quick action keyed a.g.c. circuit, a "hi-sweep" voltage multiplier system, an advanced twelve-channel turret tuner, full 4 mc. bandwidth, and excellent sensitivity.

The kit comes complete with carefully planned schematic and pictorial diagrams.

The new kit is available in two models. The deluxe kit, Model 630D19, has the principal components mounted in place while the standard kit, Model 630S19, comes unassembled. Both kits include all components, picture tube mounting brackets, speaker, and all tubes. The picture tube, wire, and

solder are not furnished. The chassis measures 21¾" wide by 15¾" deep.

CROWN ROTATOR

Crown Controls Co., Inc. of 124 So. Washington Street, New Bremen, Ohio has announced the availability of a new antenna rotator drive motor

which features ⅝" steel drive shafts and 3" final shaft steel gears for greater strength and more turning power.

This newest rotator in the company's line is available in two control box styles. One model features an electric eye which flashes the position of the antenna while the second model incorporates the company's compass unit which gives accurate readings showing the actual position of the antenna at all times.

A data sheet covering both models is available from the company on request.

FRINGE AREA ANTENNA

The Radion Corp. of 1137 N. Milwaukee Avenue, Chicago 22, Illinois has developed a new unit for fringe area reception which has been designated the "Suburban Television Antenna", Model 2G10.

The company claims that this new packaged unit is quick and easy to install thus saving both manpower and time. The antenna is of all-steel construction with a baked on enamel finish. It is supplied with universal mounting brackets for window, roof, or attic installations.

DEFLECTION YOKE

The Electronic Parts Division of *Allen B. Du Mont Laboratories, Inc.*, 35 Market Street, East Paterson, New Jersey has developed a new deflection yoke which is said to provide edge-to-edge sharp focus and increased sensitivity.

The new Series Y2A ferrite core deflection yoke features the company's distributed winding. It is designed for use with TV tubes of 60 to 70 degree deflection angle covering present popular tube types.

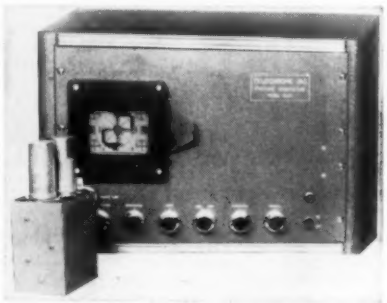
The yoke is available for use with transformer or autotransformer output circuits. It can also be supplied with different networks and lead lengths or without networks and

leads. In several standard stock types it covers the requirements of technicians and set owners for improving existing equipment. For the service trade the yokes come packed in individual boxes, complete with installation instructions.

These yokes are designed to withstand continuous operating temperatures up to 90 degrees C and voltages up to 4 kv. between any windings or between windings and frame. Standard horizontal inductance is 10.5 mh. and vertical inductance is 42 mh.

VIDEO PICTURE GENERATOR

Telechrome, Inc. of 88 Merrick Road, Amityville, Long Island, New York has announced the development of the



Model 300-A flying spot, low-cost television picture generator.

The new unit uses 3 x 4 inch slide transparencies, negatives, etc. and is designed to supplement or replace monoscopes, camera chains in TV stations, laboratories, factories, schools, and colleges.

The generator is completely self-contained with regulated power supplies. Resolution is greater than 500 lines and meets RTMA picture quality specifications. The unit will operate on standard driving pulses, off-the-air sync, or on self-contained sweep generators.

Details on the Model 300-A, which is supplied with a driven sweep 10" monitor, are available from the company.

TWO-STAGE TV BOOSTER

The Mark Simpson Manufacturing Co., Inc., 32-28 49th Street, Long Island City, New York has just developed a

new two-stage television booster designed particularly for fringe area installations.

Known as the *"Masco* Super Skychief Booster," the new unit eliminates any overloading of the TV set by in-

corporating a two-knob control which makes it possible to utilize the amount of gain required.

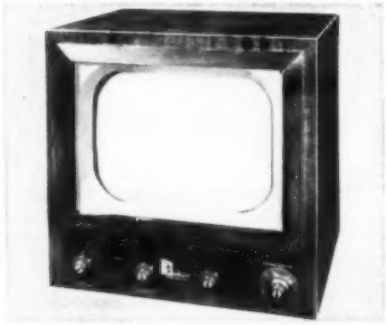
In the "Off" position, the booster permits the TV set to operate through its direct connection to the antenna without booster action. The unit has 8 tuned circuits with uniform gain on all channels.

The booster is housed in a baked mahogany hammertone finished cabinet with a sloped dial panel.

A.C.-D.C. RECEIVER

The *Colen-Gruhn Company, Inc.* of 387 Fourth Avenue, New York 16, New York is handling distribution on a new model direct current television receiver which has been developed by *Gotham-Visionaire* especially for the d.c. consumer market.

The new set uses a 17" picture tube, has 27 tubes, and features a built-in antenna, four stages of i.f. amplification, steady high voltage power supply, and FM sound. The set can be operated in d.c. areas without the use of



inverters, vibrators, or motor generators. It is also designed to operate on a.c.

The receiver is currently available in a mahogany table model with console models scheduled for early production.

"RADARRAY"

The *Gonset Company*, 72 E. Tujunga, Burbank, California has added a new antenna to its line of fringe area equipment.

The new broadband, low channel array utilizes new principles which provide high gain and front-to-back ratio on Channels 2 through 6. Employing stacked colinear dipoles ahead of a duplicate dipole curtain which is connected in quadrature with all elements driving the feed point, the array is much less frequency sensitive than high gain arrays using parasitic elements.

While quite large physically in order to obtain the maximum practical gain, the array is ruggedly constructed to withstand icing and high winds.

NEW 20" TUBE

Hytron Radio & Electronics Corp., Salem, Massachusetts has announced the availability of a new 20" direct-view picture tube, the Type 20FP4.

This rectangular screen unit, which has a standard 4 to 3 aspect ratio,

utilizes electrostatic focus and magnetic deflection to provide a 17" x 12¾" picture.

An unusual feature of the new tube is its focusing method. It employs a focusing electrode of zero current design which allows the set designer to eliminate the entire magnetic focusing assembly.

The relatively flat face of the new tube incorporates a neutral density gray filter to increase the contrast ratio. The 20FP4 also features an electron gun designed to be used with a single magnet external ion trap magnet.

Full details on the 20FP4 are available from the company's Commercial Engineering Department.

HIGH VOLTAGE CONDENSERS

The Accessory Division of *Philco Corporation,* Philadelphia, Pa. has announced a new line of twenty-six condensers which have been designed specifically for high voltage, high temperature applications.

The new condensers, rated for dependable operation up to 85 degrees C., are housed in a newly designed molded phenolic casing which is humidity resistant, non-inflammable, and mechanically sturdy. Corona has been minimized in the electrical design of these units and a specially treated mineral oil has been utilized as the condenser impregnant.

The new line is available in working voltage ranges of 3000, 5000, 6000, and 10,000 volts d.c. Each condenser has a tolerance of ± 20%. These units are being handled by the company's wholesale distributors.

GIANT TV LENS

The largest lens for a Schmidt optical system ever to be manufactured commercially is in production at the *Polaroid Corporation,* Cambridge 39, Massachusetts.

Designed to provide a 15 x 20 foot

picture, the 22½ inch lens is cast from liquid plastic by means of a unique war-born technique developed by the company.

The new lens is to be used in an *RCA* theater television projection system.

—30—

Sound Engineering

(*Continued from page 62*)

impedance, for a given amount of power at the input, the level at the output of the amplifier will be lower by 2.22 db., as compared to the first transformer.

When one circuit is bridged by another, a loss of power will take place. This is termed "bridging-loss." If the bridging circuit impedance is high compared to that of the circuit bridged, the power loss will be small. To calculate the loss of power for such a condition, equation (7) is used:

$$db. = 20 \log_{10} \frac{2\,Br + R}{2\,Br} \quad \ldots \ldots \quad (7)$$

where: Br equals the bridging resistance and R the circuit bridged.

As an example, assume we have a circuit of 600 ohms impedance and we wish to bridge it with a 7500 ohm vu. meter. How much power is lost? Substituting in equation (7),

$$db. = \frac{15{,}000 + 600}{15{,}000} = 1.04$$

$$20 \log_{10} 1.04 = 20 \times 0.0171 = 0.342\ db.$$

If the original level in the 600 ohm circuit was a plus 4 dbm., bridging the meter across it will reduce the level 0.342 db. The true level is now plus 3.658 dbm.

In dealing with a device such as an attenuator, which provides a net loss of power, the output power will always be smaller than the input power. In this case, it is more convenient to invert the power ratios, voltage ratios, or other such factors, in order that we may deal with numbers larger than one. If this method is used, the calculations will result in positive values, the same as for a gain calculation.

In the use of logarithms, the characteristics are: $1 = 0$, $10 = 1$, $100 = 2$, $1000 = 3$, etc. Given a power ratio of 1000/1 it would be evident that $10 \log_{10}$ for this ratio would be 10 x 3 or 30 db. Or, when the voltage or current ratio is given it becomes, 20 x 3 or 60 db. Table 1 illustrates how widely divergent ratios may be calculated easily by inspection.

Fig. 1 is a diagram of an amplifier and the various formulas that may be used to determine its gain, depending on known factors and whether the input and output impedances are equal or unequal in value.

Several different methods may be used for defining and computing gain or loss. These methods differ only in the way the reference power and the one to be compared are chosen. The method used depends largely on the circuit conditions, impedance, and how the gain or loss of other units in the system have been computed.

In making an analysis of the characteristics of an amplifier the gain may be calculated for the amplifier as a whole or for a single or group of stages.

The difference in level for two cir-

cuits of unequal impedances may, when the voltages are the same, be determined by the use of equation (8):

$$db. = 10 \log_{10} \frac{Z_1}{Z_2} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (8)$$

A typical case where equation (8) would be used is given below. Assume we have two circuits, one 500 ohms and the other 250 ohms. What is the difference in level across the 500 ohm circuit in db., compared to the 250 ohm circuit, for a given voltage?

$$db. = 10 \log_{10} \frac{Z_1}{Z_2} = 10 \log_{10} \frac{500}{250} = 2.0$$

$$10 \times \log_{10} 2 = 10 \times 0.301 = 3.01 \; db.$$

If the output level of an amplifier is stated in decibels and it is desired to convert it to watts output, equation (9) is used.

$$P = \left(\text{antilog } \frac{db.}{10}\right) \times \textit{Reference level} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (9)$$

To illustrate the use of this equation suppose we have an amplifier which has a measured output level of plus 30 db. (6 milliwatt reference level). Substituting in equation (9):

$$\left(\text{antilog } \frac{30}{10}\right) \times 0.006 = (\text{antilog } 3) \times 0.006 = 1000 \times 0.006 = 6 \; \textit{watts}$$

Equation (9) is used only for positive values of db. For negative values, equation (10) is employed.

$$P = \frac{\textit{Reference Level}}{\text{antilog } \frac{db.}{10}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (10)$$

Fig. 2 is a block diagram of a typical recording system which is designed to illustrate the wide range of levels encountered, and how the decibel is employed to determine the operating levels at various points in the system. Above each block is given either the gain or loss of the device in decibels. Also, at various points in the circuit are shown the operating levels, which are created by the gain or loss of devices, such as the mixer, filters, master gain control, recording equalizer, and the amplifiers.

It will be noted that the output level of the microphone at the left is a minus 53 dbm., while the input level to the disc recorder cutting head at the right, is a plus 30 dbm. These levels indicate that a net gain of 83 db. will be required between extremes.

Starting at the left of the diagram, a microphone has been selected which has an average output level of minus 53 dbm. at 1000 c.p.s. This is followed by a preamplifier of 40 db. gain. The preamplifier raises the output level of the microphone to a minus 13 dbm., which is fed into the mixer input.

The mixer introduces two losses into the circuit. The first, which is fixed and created by the resistive network of the mixer, is called the "insertion loss." A second is created by the attenuation of the mixer pot which, for this example, is 15 db. These two losses

result in a total loss for the mixer of 35 db.

A booster amplifier with a gain of 30 db. is connected at the output of the mixer to compensate for the losses incurred by the mixer. Following the booster amplifier is a master gain control, with an average loss of 20 db. Two filters, a high-pass and a low-pass, follow next. In the filter passbands the insertion loss is one-half db. for each, or a total of 1 db. for the two. A line amplifier follows the filters with a gain of 43 db.

At the output of the line amplifier is a bridging bus, operating at a level of plus 4 dbm. This bus feeds a monitor amplifier and speaker, operating at an output level of plus 23 dbm. Also fed from the bus is a bridging amplifier, recording equalizer, and power amplifier, the three devices being in tandem, for driving the disc recorder cutting head. The gain of the bridging amplifier is 18 db., and is equivalent to the loss of the recording equalizer which is 18 db.

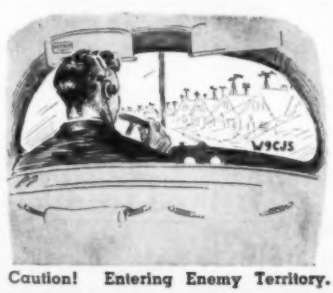
The purpose of the bridging amplifier is to make up for the loss created by the recording equalizer, therefore, the level at the output of the equalizer is the same as the bridging bus, a plus 4 dbm.

The gain of the recording amplifier must be sufficient to raise a level of plus 4 dbm. to a plus 30 dbm. Consequently, the gain of the amplifier must be 26 db. Using the same reasoning, the monitor amplifier must have a gain of 19 db. for an output of 23 dbm.

To determine the net gain of such a system between the output of the microphone and the input of the cutting head, all the gains are added, which amounts to a total of 157 db. Adding the losses gives a total of 74 db. Subtracting the total loss from the total gain gives a net gain of 83 db. This is the amplification required to secure a plus 30 dbm. at the cutting head, for a signal of minus 53 dbm. at the output of the microphone. In other words, if we substitute a minus 53 dbm. signal of 1000 c.p.s. for the microphone, we would obtain a signal of plus 30 dbm. at the cutting head for the conditions set forth.

A tabulation of the various gains and losses and how they are added is shown in Table 2. The methods used for determining the operating levels for recording systems will be discussed in a forthcoming issue.

(To be continued)



Caution! Entering Enemy Territory.

Pricing Service

(*Continued from page 48*)

decent price schedules that represent an over-all profit.

The end result is that while these small shop owners have overhead expenses that are as inevitable as those of larger shops their overhead is too often paid for out of the small shop owner's own "wages," spread over a period of time.

If the small shop owner does not keep adequate books—and he usually does not—he is totally unaware of the huge sums of money dribbled away in the course of the year for a hundred and one overhead items.

If the new shop owner starts out with considerable capital saved from his wage earning days, he may acquire a new truck that involves no particular expense for the first year or more, except gas and oil and, perhaps, a tune-up or two. So, he figures his transportation is costing him only a dollar or two a day business expense. What, says he, is this nonsense about big overhead?

Yet, there must come a day of reckoning when he has a $200 or $300 complete overhaul job. That expense comes out of his own pocket because he has not charged enough overhead to jobs done, and long since completed and paid for, while the truck was building up to this expensive overhaul item.

Meantime, his truck is depreciating in value. If it cost him $2500 when he acquired it, and it is depreciating at the rate of $500 a year or more, this means an additional transportation expense of $1.67 a day. What has actually happened is that he has prepaid or advanced this daily expense at time of setting up in business and purchasing the truck.

This situation won't catch up with him for several years. Finally, one day he'll wake to the realization that he has a broken down jalopy on his hands. His initial investment is gone and he has not set aside reserves each year to replace this worn-out truck. Even if aware of the eventual need for a truck replacement, he has not charged enough for his service to make a reserve fund possible.

The same thing is happening to his shop equipment and one day he will have a failing business with a job-lot of broken down and obsolete equipment.

Moreover, because, as his little classified ads boast: "I do my own work," he doesn't have the protection he used to have when he worked for wages. He is not covered by unemployment insurance, which he is going to need some day, thanks to his unbusiness-like methods. Neither is he covered by workmen's compensation. In soliciting work he frequently explains to prospective customers that, because he doesn't need to pay out such expenses on himself, he can work more cheaply. Can he?

Comes a day when he falls from a roof while installing an antenna and is injured on the job. His income stops and he and his family face stark tragedy. Why? Because his customers have had the benefit, in lower contract prices, of the insurance protection he failed to have on his own person.

Actually, the one-man shop owner or, for that matter, the owner running a crew of men, is as much entitled to hedges against accidents and sickness, unemployment and old age benefits as is the wage earner. He is being a sucker if he doesn't have this protection. By charging to jobs a percentage for such protection, just as he does where he employs technicians, he will be able to carry an accident and sickness policy on himself and lay aside funds over the years for his old age, or pay on an annuity. While he cannot enter this as a cost of doing business, or deduct it in his income tax return as a business expense, he is certainly entitled to enough profit to make such insurance and savings possible.

The small shop owner, in establishing prices and making service charges, should set his sights higher. Even if he does not fully attain his objectives immediately, he will certainly better himself to some extent. He should not only figure to recover his own labor at the going rate, but he should attempt to make enough to cover his own personal protection against the hazards of life in the same way a wage earner is now covered. In addition he should find out what his real overhead is.

Finally, he should add a reasonable percentage for *net profits*. That is, a real job profit should be his after everything else is paid for. This is an amount to which he is entitled.

Unless and until the small shop owner adopts such a course of action and sticks with it, he stands an excellent chance of closing each year's business with less net earnings than he would have working for wages, even though he may not immediately be aware of this fact, thanks to inadequate bookkeeping.

It is this writer's firm conviction that practically no shop owners price below cost for service from a desire to under-cut, as such. Almost invariably where cut-throat prices exist they come about from a lack of understanding of all the cost factors borne by the shop owner.

When the under-pricing shop owner adopts correct pricing procedures that reflect all of his overhead charges and permit a profit, he will no longer have the stigma of being an unfair competitor. And he won't have a class of trade made up of the chiseling fringe of his community. He will be gradually building up a type of trade where a profit is possible on every job. That's the only kind of business that holds any future for him. That's the invariable course followed by small shop owners who, today, have grown to large ventures enjoying the respect of their home towns.

—30—

Technical BOOKS

"PRACTICAL RADIO AND ELECTRONICS COURSE" edited by M. N. Beitman. Published by *Supreme Publications,* Chicago. 330 pages. Price $3.95.

This is the 1951 edition of a well-known text which is designed for the home study of radio and electronics. For the first time all of the lessons previously issued as three small volumes have now been included in a single binding. The material in volume one covers the fundamentals of radio and electronics. A unique method of presentation in this and the other two volumes allows the student to check his comprehension of the subject as he goes along by means of test questions and additional notes which parallel the text. The chapters covering "fundamentals" include a discussion of such subjects as radio components; symbols used in radio schematics; the mounting and wiring of parts; mathematics of radio; resistors and their use in radio circuits; battery testing; Ohm's Law and Kirchhoff's Laws as they pertain to radio; the properties of coils and transformers; condensers; *L,C,R,* and combined circuits; meters and their operation; vacuum tubes; power supplies; audio amplifiers and accessories; r.f voltage amplifiers; and detection.

The second section covers various radio receiver circuits and typical examples; electronic oscillators; transmitter circuits and typical examples of such circuits; lines, antennas, and radiation; test equipment using meters; electronic test equipment; a.f.c.; FM; and the fundamentals of television.

The last section of the book is devoted to applied electronics and radio servicing. Included in this volume is data on various types of communications and industrial electronic equipment along with salient points on its construction and operation.

The text is clearly written, lavishly illustrated, and easy to understand. Persons unable to accept formal training in radio and electronics will find this home-study course a good introduction to the field and a springboard to more advanced study.

* * *

"OPPORTUNITIES IN TELEVISION" by Jo Ransom and Richard Pack. Published by *Vocational Guidance Manuals,* New York. 127 pages. Price $1.00.

While most of the material in this little handbook is concerned with the studio and programming end of television, the book devotes one complete chapter to the job opportunities and technical requirements of installation, repair, and service technicians.

The authors have divided their book into eleven chapters, a bibliography, and several appendices. There are chapters on the over-all picture of television as a career, the requirements for actors, writers, directors, engineers,

the job openings in the production end of telecasts, sales and promotion, research, in advertising agencies handling TV accounts, in programming, special events, news and announcing, and as technicians.

The bibliography includes a list of theater and film books in addition to a list of television, radio, and advertising periodicals. The appendices outline television courses of study, TV organizations, a job inventory, the operation of small TV stations, commercial TV stations now in operation, and a glossary of TV terms.

* * *

"RADIO & TELEVISION ALMANAC" by Orrin E. Dunlap, Jr. Published by *Harper & Brothers,* New York. 198 pages. Price $4.00.

This text has been designed as a reference work for broadcasters, newspaper personnel, radio station staffs, and advertising agency personnel. It carries a chronological listing of landmarks in the radio and television field from 1844 to the present time.

In addition to recording such historical events as the first wireless contact, the first commercial broadcast, the first telecast, etc., the author has included data on important patents and inventions pertaining to electronics. A particularly valuable appendix lists members of the former Federal Radio Commission and its successor, the FCC; presidents of the IRE; presidents of the National Association of Broadcasters; presidents of the RMA; and presidents of the Television Broadcasters Association.

One interesting and historical section of the book includes over sixty photographs of "firsts" in the radio and television industry, pictures that record for posterity such events as the broadcasting of the Dempsey-Carpentier "Battle of the Century," the first broadcast made by a president of the United States, the first telecast of a president's speech, and the first successful wireless telephone contact.

Many of the day-to-day questions which arise in connection with television and radio are answered in this book.

* * *

"WIRELESS SERVICING MANUAL" by W. T. Cocking. Published by *Iliffe & Sons, Ltd.,* London. 292 pages. Price 12s/6d, postage 5d.

This is the eighth edition of a text which is well known to both technicians and hams since it provides not only servicing data on radio receivers but also the answers to problems which often arise in the construction of amateur gear and in experimental work.

The text carries chapters on test equipment; current and voltage tests; the interpolation of meter readings; tubes; power line hum; motorboating; the causes and cure for instability in r.f. and i.f. stages; frequency and amplitude distortions; background noise and local interference; and tracking straight and superhet receivers. Troubleshooting for whistles and heterodyning; a.g.c. systems; short-wave receivers; short-wave converters; speak-

ers; antenna grounds; a.f.c.; push-pull amplifiers; negative feedback; miscellaneous circuit faults; the TV receiver; and the use of cathode-ray test equipment are also covered.

The appendix includes information on common circuit constants; standard symbols; formulas frequently required in radio work; antennas and feeders; copper wire tables; and circuits of some commonly-needed items of test equipment. —30—

Within the Industry

(Continued from page 28)

tory in Long Island City to supplement its two existing plants in the area . . . **GLOBE-UNION, INC.** has added 65,000 additional square feet of manufacturing space for its **CENTRALAB** division at 424 North Fourth Street in Milwaukee . . . **NATIONAL ELECTRONIC MANUFACTURING CORPORATION** has moved to new and larger quarters at 4202 Vernon Boulevard, Long Island City, New York . . . The **CROSLEY DIVISION** is expanding its plant in Richmond, Indiana, to provide an additional 211,200 square feet of manufacturing space. Construction of the new building is expected to be completed by October 1st of this year . . . Foundations have been completed for the new, 100,000 square foot radio and television center being erected by station **WCAU** on a 10-acre site outside of Philadelphia's business district. Completion is scheduled for the spring of 1952 . . . **SYLVANIA ELECTRIC PRODUCTS INC.** has purchased a new factory site at Woburn, Massachusetts. The factory, when completed, will be used for the production of electronic tubes and equipment for national defense . . . The Northwestern district headquarters and the Chicago sales office of the **WESTINGHOUSE ELECTRIC CORPORATION** have been moved to a new and permanent location on the second floor of The Merchandise Mart in Chicago. The new facility provides 45,000 square feet of space . . . **MOHAWK BUSINESS MACHINES CORPORATION** has recently moved its home office to 47 West Street, New York . . . **POTTER AND BRUMFIELD** is building a new and modern plant in Princeton, Indiana which will more than double the company's production capacity . . . The headquarters plant and engineering laboratories of the **WESTINGHOUSE ELECTRIC CORPORATION'S** new Electric Tube Division will be located on a 100 acre tract four miles northwest of Elmira, New York. Completion of the construction work is scheduled for early next fall . . . **TECHNOLOGY INSTRUMENT CORPORATION** has moved into its new plant in Acton, Massachusetts. The company was formerly located in Waltham . . . **SYLVANIA ELECTRIC PRODUCTS INC.** is building a new plant in Burlington, Iowa, for the manufacture of radio receiving tubes. —30—

Quality Amplifier

(*Continued from page 45*)

for peaks with an oscillator and scope, and to make overload tests at about 20 cycles to look for bursts of high-frequency oscillation.

Overload Stability

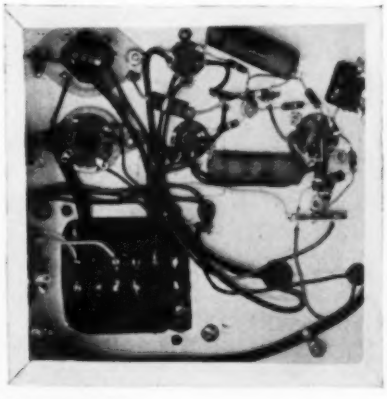
Feedback amplifiers of this sort are susceptible to instability under overload conditions at low frequencies. This trouble is completely eliminated in the circuit described, but it always pops up when a new design is being worked out. What happens is that on low frequency overload peaks the output transformer core becomes momentarily saturated, its inductance drops way down and all its characteristics go to pot. On these peaks, then, the constants in the feedback loop momentarily go through a big change when the transformer is included in the loop, and oscillation is prone to result. In this type of circuit, then, it is necessary to use a good transformer to start with and to provide a large margin of stability against oscillation. Commonly this is done by connecting a condenser of .005 μfd. or more across the output tube plates in order to drop the gain way down at the higher frequencies. This results in inadequate feedback at high frequencies and more distortion. In the present circuit, the condenser is left out, and the requisite stability obtained by careful over-all design.

Phase Inverters

Another source of instability at or near overload is the phase inverter. In the usual circuits, the phase inverter tube gets its grid signal from an amplifier tube which is itself driving one side of the output stage. When the output stage begins to draw grid current, not only does the excitation drop off, but the phase inverter loses its grid excitation too. This causes the input to the output stage to become lopsided, leading to premature saturation of the output transformer and general instability.

With the split-load phase inverter both sides overload symmetrically and

Under chassis view of TV sound amplifier.



Triode Characteristics	(6V6 or 6AQ5)
Amplification Factor	9
Plate Resistance	2400 ohms
Mutual Conductance	3800 micromhos
As single-tube class A_1 Power Amplifier	
Plate Voltage	300 v.
Grid Bias	−20 v.
Plate Current	30 ma.
Load Resistance	8000 ohms
Power Output	1.5 w.
As push-pull class A_1 Amplifier	
Plate voltage	300 v.
Grid Bias	−25 v.
Plate Current	50 ma. (2 tubes)
Cathode Resistor	470 ohms
Load Resistance	12,000 ohms (p. to p.)
Power Output	4.5 w.

Table 1. Characteristics of 6V6 or 6AQ5.

the general behavior at and near the overload region is a lot smoother. Both the straight conventional inverter and the "floating paraphase" modification of it were thoroughly tested in this amplifier, and discarded in favor of the one shown. The split-load inverter does have the disadvantage of lower maximum voltage output, but in this application the voltage swing capability of both the voltage amplifier and the inverter stages are adequate, as indicated by the curve of Fig. 2.

This amplifier is completely stable both under load and on open circuit, at all signal levels including extreme overload, at all frequencies.

It is advisable not to add any unnecessary stray capacitance to ground across the plate circuit of the first stage V_1.

D.C. Coupling

The d.c. operating point of the phase inverter needs some attention. For lowest distortion the voltage drop across R_6 and R_7 should total about 70 volts each. This places the cathode of this triode about 70 volts above ground. To avoid straining the cathode-heater insulation it is inadvisable to operate the cathode above about plus 90. This is the reason for the unusually high plate load resistor on the first stage—to make the d.c. plate potential low enough. Condenser coupling was tried between these stages and found to give no advantage.

When the power is first turned on, the plate supply voltage appears before the tubes' cathodes are warmed up. This allows the phase inverter tube grid, and hence its cathode, to rise almost to the "B" supply potential for a few seconds. To prevent damage to the heater-cathode insulation by this transient potential, a 2.2 megohm resistor, R_5, is connected from the grid of the phase inverter to ground. During warmup, this resistor acts as half of a divider in conjunction with the plate load R_4 and limits the cathode potential to about 150 volts.

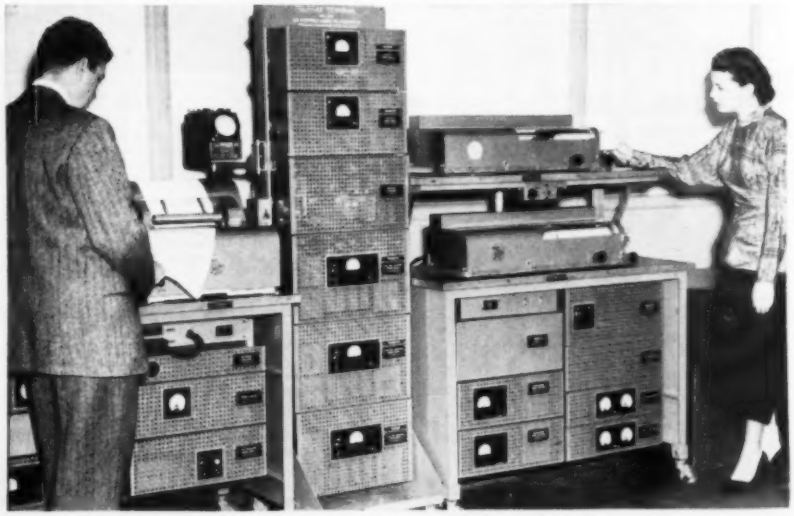
If a slow-heating rectifier tube is used, such as the 5V4G or 6AX5, resistor R_5 can be omitted. Its shunting effect on the audio output of V_3 is small, however, since the plate impedance of the 12AX7 as used here is around 200,000 ohms.

Power Supply

Except for the rather small amount of filtering used, the power supply is entirely conventional. While the writer is not one to skimp on using chokes, it was found that in this case the filter shown was completely adequate.

The power transformer shown in the photograph is a surplus unit that happened to be on hand. Any transformer supplying 300 volts each side of center-tap at 50 milliamperes or more is satisfactory. —30—

The Western Union Telegraph Company recently introduced a new facsimile unit—the "High-Speed Fax." Capable of transmitting or receiving any written, printed, or picture matter at high speed over any distance, the copy requires no advance preparation or processing whatsoever. Transmission and recording, in finished form, is at the rate of 3000 words of newsprint a minute or 180,000 words an hour. The capacity of the new system is so great that a 90-page issue of a magazine could be flashed by facsimile to any distant point in one hour. The received material is printed on a new electro-sensitive dry recording paper, tradenamed "Teledeltos."



International Short-Wave

(*Continued from page* 118)

sent with the transmitter were not of correct value for the 25-m. tank and new ones were on order via airmail from California. (Boice, Conn.) *Watch for TGNA on 11.85 around 2200-2230.* Other channels are 6.039, 9.668 (still announced 6.040, 9.660, says Kroll, N. Y.). The station often interviews missionaries in Guatemala and other Central American countries—usually after (normal) 2230 closedown. The Mailbag Program at 2230-2245 on Wednesdays sometimes runs as late as 2300, according to Sklenar, Cuba (formerly of Nebraska), and others.

TGTQ, *Radio Internacional,* noted on 6.285 at 0115-0200. (Machwart, Michigan). A Guatemalan station was heard recently on about 6.33 with marimba music at 1843; fair level; may be TGTA, listed 6.335? (Bellington, N. Y.)

Haiti—4VEH, Cap Haitien, noted leaving the air 1830 on 9.745 and announcing return at 2200 on 9.730. (Hoffman, N. Y.) *Radio Sweden* says this one has moved from 9.885 to approximately 9.745; opens 0700; uses 9.745 "mornings" and 9.730 "evenings;" a verification card is being printed; that 4VRW, Port-au-Prince, is back on 9.840, opens 0650. Oskay, N. J., recently measured 4VEH as 9.746V at 0745; and as 9.728 at 1840.

Hong Kong—ZBW3, 9.5242, measured recently at 0710, when had Chinese musical program; some QRM to 0730, very good signal after that time. (Oskay, N. J.) Should take a BBC news relay around 0600.

India—AIR noted signing on in *English* at 1000 on 15.290, announced as operating in the 19- and 31-m. bands; heard signing on in *English* at 1400 on 7.155 and 9.270, news to 1410, then music to 1500. Noted with *English* for Southeast Asia on 17.84 at 0830, announced 15.350 as parallel; 1030 news heard on 6.010. Madras, 4.920, noted 1045 with AIR news relay. (Pearce, England). This one is fair level in West Virginia with news 0730.

Indo-China—Radio France-Asie, Saigon, noted on 11.780 signing off 1000 with *English* identification and "La Marseillaise." (Russell, Calif.) This one has news 0900. Is heard by Hutchins, *Radio Australia,* on 9.524, *after* 0500.

Latest available schedules from *Radio France-Asie* include *English* at 1700-1800 and 1945-2000 on 9.524; at 0500-0515 on 11.830; 0900-0915 on 11.780; *English* period for Australia-New Zealand 0420-0500 on 11.830 and for Southeast Asia 1930-1945 on 9.524; lists entertainment in French daily 0800-1015 on 9.524 and "bilingual" entertainment daily same time on 11.780; lists French at 1715-1730 on 9.524, 1815-1845 on 9.524, 6.116, 1915-1930 on 9.524, 6.116, 2115-2130 on 11.780, 2345-0000 and 0700-0735 on 9.524, 1015-1030 on 11.780, 9.524; lists Mandarin (Chi-

nese) 1345-1900, 2245-2300, 0400-0415 on 9.524, and Cantonese (Chinese) at 2245-2300, 0415-0430, and 0745-0800 on 6.116. (Wadhams, Calif.)

Indonesia — YDC, 15.15, Djakarta, noted 1000-1030; news 1015. (Sutton, Ohio) Heard on this channel closing *English* period at 1028 and announcing channels in use as 15.150 and 4.910; mentioned three daily *English* broadcasts—0600, 0900, 0930, and said at 1030 would continue in Hindustani. Noted on 15.15 signing on 0930 with home and world news; "Open Letter" at 0945. (Pearce, England) YDF, 6.045, noted 1830 announcing as *Radio Nacional.* (Grischott, Calif.)

Iraq—The Iraq Broadcasting Station, Baghdad, sent a QSL card recently verifying reception of January 3, 1949, on 7.092; said *new* transmitter is *Marconi* type S.W.E. 10 s.w., 16 kw. to antenna in operation March 1951; class B modulation; antenna omni-directional; schedule is 2330-0100, 0430-0600, 0830-1500; Arabic and occasional European music and talks; interval is bird call; time signal is clock striking; said, "Many regrets for delay; please report on new transmitter later." (Pearce, England) Has a new verification card. (Radio Sweden) *ISWC*, London, lists YI5KG, 7.092, at 1000-1700. At times may use 7.062.

Israel—4X4EA, 6.725, Israeli Forces Station, noted signing on with bugle call and identification by woman at 1130; played varied records, interspersed with talks; noted another day signing off 1500 with bugle sounding "Lights Out;" *no English heard.*

According to announcement, Tel Aviv, 9.0108, is now the only short-wave outlet carrying the "Voice of Zion" (*English*) relay from Jerusalem at 1700-1745 daily; that period is no longer relayed by Jerusalem 6.830. The news is 1515 over both Tel Aviv, 9.0108, and Jerusalem, 6.830, and *English* is also announced for 0700 on 6.830. A more recent measurement of Tel Aviv's HXB21 (announced 9.000) was 9.0125V, according to Oskay, N. J.

Italy—Rome noted with *English* 1415-1500 on 9.575, 11.905. (Pearce, England) Has been heard on 9.671 signing off 2200 with good level, and announcing program as at 1900-2200. (Ferguson, N. C.) I have heard this one parallel with 9.575 at the time mentioned by Ferguson.—KRB. Has news 2145-2200.

Noted on 6.010 with news 1900-1915, bad QRM. (Lane, South Dakota) Heard opening in foreign language 1030 on 15.120, 15.313. (Grove, Ill.)

Jamaica—McWalter, Scotland, received this interesting data from *Radio Jamaica*—"Our short-wave transmitter is operated on a vertical radiation pattern and is intended only to give good reception throughout the island of Jamaica. However, when weather conditions are favorable for skips, we are occasionally heard in other parts of the world. You may be interested to know that we use a standard broadcast transmitter on 880 kc. to cover the metropolitan area of Kingston, but

owing to the mountainous terrain of this island, a short-wave transmitter also is necessary for complete island-wide coverage."

The 3.360 outlet recently seems to have extended program to 2310 so it can take the BBC news relay at 2300. (Bellington, N. Y., others) Closes with "God Save the King."

Japan—AFRS, 11.80, Tokyo, noted with popular American recordings 0245-0300 sign-off. (Bellington, N. Y.) The AFRS outlet on 4.860 heard with news 0400; JKL, 4.940, heard with NHK program 0800-0830; only *English* is call-letters "N.H.K." (Callarman, Oregon) NHK program noted on 9.695 at 1740, light musical selections, announcements by man in Japanese, call at 1759, followed by time pips; heard on 9.655 at 1725 with talk in Japanese by man, and time pips noted at 1800. (Pearce, England)

BCOF (British Commonwealth Occupation Forces), 6.105, Kure, is scheduled 1630-0830 (Saturday to 0900). (Radio Australia)

Kenya—VGQI, 4.855, Nairobi, is being heard in the United Kingdom at 1300 with news, then recordings; closes 1400 and announces will return at 0600. (ISWC, London)

Lebanon—Beirut, 8.036, noted 1530 with news in Arabic; signed off 1600 with march recording. (Pearce, England) Heard recently 0005-0015 with native news, then music to 0030; good level in Ohio. (Sutton)

Madagascar—FIQA, 9.515, Tananarive, noted with music 1050, announcements in French. (Russell, Calif.) Heard here in West Virginia signing on with interval signal and "La Marseillaise" at 2230, using French; noted then by Ferguson, N. C., and with news in French 2311-2325.

The 7.38 channel normally carries Malgache or Comorian programs but may have French on occasion. (Ridgeway, South Africa)

Malaya—Radio Malaya, 7.25 and 7.200, has not been heard lately; the 6.135 outlet carries native programs mornings. BFEBS, Singapore, is back on its proper channel of 11.880. (Balbi, Calif.) Is heard fairly well early mornings, around 0700-0830, here in West Virginia. BFEBS, 15.300, noted by Lane, South Dakota, fair at 1100 and signing off at 1130.

Malta—Pearce, England, and Bellington, N. Y., report that when FBS, Middle East, closes at 1600 on 7.220 it announces frequencies of 15.125, 7.220, 6.015, 3.305; Pearce says when it closes 0200 on 7.220 it announces return at 0530 on 15.125, 7.220, 3.305.

Martinique—Fort-de-France, 9.700, can be heard *after* 1730 when a USA station leaves that channel. (Stark, Texas, others) Noted with news in French 1834, and signing off 1839 (did *not* play "La Marseillaise"). (Arthur, W. Va.) Is heard in Britain. (Pearce)

Mauritius—V3USE, 15.050A, noted in French 1159 and signing off 1230 with "God Save the King;" *no English noted.* (Pearce, England) Is heard in South Africa at 1000. (Ridgeway)

ISWC, London, lists schedule as 2200-2315, 0300-0430, 0930-1230.

Mexico—XEBT, 9.625, noted signing off 0000; XETT, 9.557, heard leaving the air 0045. (Guzman, Cuba) XEQQ, 9.680, Mexico City, heard signing off 0115. (Grove, Ill.) The Mexican on 11.900 closes 0100; now seems to use short-wave call of XEXE; relays XEX. (Machwart, Michigan) Noted in New York at 1230 with good level, but some fade. (Bellington) May be as high as 11.903 in frequency; noted 1830. (Stark, Texas)

Monaco—Radio Monte Carlo, 9.785, 6.035, listed to close 1700, noted some days as late as 1750 but gone by 1800. (Guentzler, Ohio, Bellington, N. Y.)

Mozambique—The 60-m. channel which signs on with *English* program at 2300 in parallel with 11.764 seems to be as low as 4.915 now; CR7BU is listed 4.932.

Nepal—Schedule is 2300-2330 and 0330-0430 on 7.100 and 60 mc.; 0915-1015 on 7.000 and 60 mc.; announces in *English* at sign-on of each transmission. (Radio Australia)

New Zealand—Wellington recently effected these *new* schedules—*To Australia* 1300-1545 and 0200 to closedown, ZL8, 9.620; 1600-0145, ZL10, 15.220. *To Pacific Islands*, 1300-1545 and 0200 to closedown, ZL3, 11.78; 1600-0145, ZL4, 15.28; normal closedown is "from" 0620; however, during power restrictions the service has been closing weekdays 0530, Saturdays 0620, and Sundays 0500. (Radio Australia)

Nicaragua—YNHB, 6.555, noted with station announcement in Spanish by man 2345; popular recordings with *English* lyrics followed at 2346. (Bellington, N. Y.)

Pakistan—Radio Pakistan noted on approximately 5.990 with news 1015-1030; at 1030 says the program "came to you in the Home Service of Radio Pakistan;" news in Urdu follows; best signal in Britain from Pakistan, however, is at 0210-0220 over 17.770 (news).

A letter from *Radio Pakistan* verified the 7.140 outlet as Dacca, APD2, 7.5 kw. Stated the 0700 news is beamed to Burma. (Dary, Kans.)

Panama—HOLA, 9.505, Colon, noted 2245-2300 sign-off. (Machwart, Michigan) HP5B, Panama City, lately has been on measured 6.0325V; noted 0630 with music; previous measurement was 6.0304. (Oskay, N. J.)

Peru—From the U. S. Embassy in Lima, Lt.-Col. Bill Frederick has sent along this list of Peruvian schedules (with name of station in parenthesis)—OAX2A, 6.000, 0.25 kw. (Trujillo), Trujillo 0700-2400; OAX4V, 6.010, 0.50 kw. (America), Lima, 0700-2400; OAX4Q, 6.020, 1 kw. (Victoria), Lima, 0700-0300; OAX6B, 6.035, 0.20 kw. (Landa), Arequipa, 0700-2400; OAX6A, 6.042, 0.20 kw. (Arequipa), Arequipa, 0700-2400; OAX6E, 6.055, 0.30 kw. (Continental), Arequipa, 0700-2400; OAX4S, 6.070, 0.30 kw. (San Cristobal), Lima, 0700-2400; OAX4Z, 6.082, 15 kw. (Nacional), Lima, 0700-2400; OAX4H, 6.095, 1 kw. (Mundial), Lima, 0700-2400; OAX7A, 6.128, 0.10 kw. (Cuzco),

Cuzco, 0700-2400; OAX1A, 6.150, 0.25 kw. (Delcar), Chiclayo, 0700-2400; OBX4B, 6.170, 0.35 kw. (Azul), Cerro de Pasco, 0700-2400; OAX4G, 6.190, 0.25 kw. (Lima), Lima, 0700-2400; OAX1B, 6.198, 0.30 kw. (Piura), Piura, 0700-2400; OAX4P, 6.200, 0.25 kw. (Huancayo), Huancayo, 0700-2400; OAX6H, 9.500, 0.10 kw. (Tacna), Tacna, 0700-2400; OAX4W, 9.510, 0.50 kw. (America), Lima, 0700-0400; OAX4J, 9.520, 0.25 kw. (Colonial), Lima, 0700-0130; OAX4K, 9.545, 0.30 kw. (Central), Lima, 0700-0130; OAX4R, 9.562, 10 kw. (Nacional), Lima, 0700-2400; OAX5C, 9.590, 0.20 kw. (Universal), Ica, 0700-2400; OAX4T, 15.150, 10 kw. (Nacional), Lima, 0700-2400.

Philippines—Far East Broadcasting Co., Manila, is again testing on 9.730; noted around 0430-0530 or later; measured by Hutchins, *Radio Australia*, as 9.734. Grischott, Calif., reports DZH7, 9.730, and DZH8, 15.300, ending *English* program at 0530; continued in Burmese with Protestant hymns; announced in *English* at 0600.

DZH4, 6.000, Manila Broadcasting Co., signs off 1100; network cue is "From A to Z, it's MBC, the Manila Broadcasting Co.;" mentions DZMB, 760 kc., 1 kw.; DZH4, 6.000, 1 kw., and DZH2, 9.640, 1 kw. (Callarman, Oregon)

Poland—Radio Warsaw sent schedules by air to Pearce, England, listing *English* for 1200-1230 on 9.570; 1245-1315 on 11.740 for Europe; at 1930-2000, 2300-2330, and 0015-0100 on 9.570 for North America. However, Pearce heard a later announcement over the air from *Radio Warsaw* stating that an additional transmission in *English* is at 1630-1700 on 7.205. This 7.205 *English* period has been heard by Bellington, N. Y.; continued in foreign language, probably Polish, at 1700.

Portugal—Emisora Nacional, Lisbon, is noted on 15.380 at 0700 when Moscow closes on 15.390; signal strength improves by 0745 when Moscow returns to the air and then almost obliterates Lisbon to 0850; Lisbon closes 0900 but carrier remains to 0915 when a further program is presented to closedown which varies 1100-1130. (Suffolk, Australia, via Radio Australia) This one is good level mornings here in West Virginia; all-Portuguese. Recently measured 15.3825 at 0825, according to Oskay, N. J.

Noted on 9.747 and 11.958 at 1500-1530 and 1600-1800. (Harris, Mass.)

Portuguese Guinea—Bissau, CQM4, is still heard through bad CWQRM on approximately 5.839 at 1630-1800; news in Portuguese 1715. (Pearce, England)

Portuguese India—Radio Goa, 9.61, has good signal in South Africa at 0900-0930 (*English*); at 0930 has Portuguese announcements; commercials are used; station has confirmed schedule as 2030-1230, but can be heard in South Africa only after 0900 when SABC's *Springbok Radio* (commercial service) on 9.60 leaves the air to continue on 7.295. (Ridgeway)

Saudi-Arabia—Djeddah noted on 11.85 and 11.95 recently at 1240 in Arabic; good on both channels; also noted on 11.85 at 0245 but with bad QRM from Oslo. (Bellington, N. Y.)

South Africa—What appears to be Johannesburg, 4.895, opens with Afrikaans program at 2345; fair signal here in West Virginia; also heard in New York by Bellington, N. Y., Saylor, Va., others. SABC, Johannesburg, was noted recently on 11.937 with news 1500-1504, signed off 1505; asked for reports; bad CWQRM. (Oskay, N. J.) Some days carries Afrikaans instead of *English*.

Springbok Radio (commercial service) is scheduled 2300-0015 on 4.945; 0015-0245, 7.295; 0245-0900, 9.60; 0900-1100 and 1100-1600 (Sats. to 1700) on 7.295. (Ridgeway, South Africa)

Spain—A recent *World Radio Handbook* Bulletin said that *Radio Nacional en Malaga*, 7.022, shortly would begin broadcasting an *English* program at 2100; may have been effected by this time. At the time this was compiled, *Radio Nacional de Espana*, Madrid, had just moved from 9.369 to 9.585 where signal was much improved; *English* is still at 1515, 1810.

Sweden—"Sweden Calling DX-ers" goes on the air on Saturdays at 0215 on 6.065, 10.780; repeated 1015 and 2015 on 10.780, 6.065. (Radio Sweden) *Radio Sweden* recently changed frequencies to 6.065 and 10.780 for the 1900-2030 North American transmission and for the "morning" transmission at 0015-0235. (Radio Sweden)

Tahiti—Radio Tahiti, 6.135, still noted 2300-2345 sign-off; French news 2330. (Balbi, Calif.) Is heard with weak level here in West Virginia.

Taiwan—Taipeh, 7.133, puts in a fine signal 0400-0700; still has news 0630. (Grischott, Calif.)

Tangiers—Radio Internationale, 6.115, noted 1555 with program for French listeners; Spanish began at 1615; *no English noted;* has man and woman announcers and carries advertisements in French and Spanish. (Pearce, England)

Trinidad—VP4RD, 9.625, Port of Spain, now is scheduled 0500-2200, according to verification received. (Radio Sweden)

USSR—Radio Tashkent, 6.825, noted in *English* 1115-1130, news commentary; however, announces *English* periods for 1000 and 1045. (Pearce, England) What appears to be the Soviet Home Service on 7.180 leaves the air 2345, at least some nights. (Bellington, N. Y.) *Radio Sweden* says a Soviet station is now operating on about 10.040; may be Alma Ata.

Radio Moscow noted with news 0115-0130 on 6.110, underneath BBC. (Lane, South Dakota) Heard on 7.165 with news 2230. (Harris, Mass.) Grischott, Calif., reports Ashkarabad, 6.180, with *English* 0930; verifies in 30 days.

Vatican—HVJ noted back on 11.74 from 11.66 with *English* 1315-1330; at 1330 announced next broadcast would be in 15 minutes in French on 31.10, 41.21, 50.26, and 19.6 meters, and next

English for the next day at 1000 in the 19-, 25-, and 31-m. bands. (Pearce, England)

Venezuela — YVKF, 4.880A, heard well 2330; slogan is "Ondas Populares;" YVKM, 5.040, *Radio Continente*, heard well 2200. (Callarman, Oregon) YVKF has a show in *English* on Monday and Friday at 1800-1830 ("The 960 Club"); asks for requests for tunes; more recently announced this session would be aired also on Wednesdays. (Fox, D. C.) YVKD, 5.0528V, measured 0620 when had music; station announcement in Spanish at 0615; previous measurement was 5.062. (Oskay, N. J.)

Last Minute Tips

At the time this was compiled, *Radio Sweden* reported that the *new* 100 kw. transmitter at Moydrum, Athlone, Ireland (Eire), was ready for use but there had been no word from official sources regarding the opening. I was hearing the low-powered 17.84 outlet some days with news 1330-1345A, with QRM from Brazzaville.

Stark, Texas, and Bellington, N. Y., have been hearing a station in *English* on approximately 4.960-4.965 evenings around 1800-1930 that seems to be Belize, British Honduras.

A station noted occasionally around 2300-2330 on approximately 6.087 may be Tabriz, Iran; one opening 0030 and usually closing 0045 (0050 other days) on 6.275 mentions Yugoslavia. (Bellington, N. Y.)

* * *

Press Time Flashes

Radio Kol-Israel plans to inaugurate its new high-powered (50 kw.) m.w. and s.w. station on Israel's Independence Day, May 14. The s.w. station has been allocated 21.465, 17.880, 15.415, 11.935, and a frequency in the 31-m. band (9.500, 9.615, 9.640 have been tested). The m.w. station has been assigned 1025 kc. In addition to carrying the regular short-wave service, the new 50-kw.-er also will relay the "Voice of Zion" *(English)* session now heard 1700-1745 daily over (announced) 9.000 (measured 9.012V), Tel Aviv. (Bert Bluman, Israel, via Radio Australia) Listen for more details which likely will be given during the weekend prior to May 14—over stations which have regular DX programs—*Radio Australia*, *Radio Sweden*, Leopoldville, Copenhagen, possibly others. —KRB.

At press time, on request, we received a special report on Far East DX from August Balbi, Los Angeles, Calif.; space will not permit use of all the fine items, but here are highlights:

China—A station on 5.915 may be Mukkden (?), heard with bad CWQRM after 0500, weak to fair. Communist Chinese stations are numerous and schedules are irregular. Those on 7.10, 6.10, 5.985 (Shanghai), appear to sign on at 0400; the 9.73 (Nanking), 7.000, 6.155, 6.65 outlets sign on 0430; some are parallel when news in Chinese is given, usually

at 0830; at other times have different programs. One on approximately 6.35 signs on 0600 and carries all-Chinese; sign-off of most is 1000 except 7.10, 6.10, 10.26, 11.685, used for traffic besides regular transmissions. *Hong Kong*—ZBW3, 9.525, signs on 0500 in Chinese; relays Radio Newsreel from BBC, London, 1000, and signs off 1015. *Indo-China—Radio France-Asie*, Saigon, in 31-m. band varies in frequency; at press time was being heard on approximately 9.545 (announced 9.524) signing off 0415, back at 0515 and with final sign-off around 1028; French. Vietnam, 6.165, 9.62, has news 0915, signs off 0930. *Japan*—Noted irregularly on 6.19 after 0300; heard calling JKH over and over again at 0345, evidently used for traffic; bad QRM after 0400. *Malaya—Radio Malaya*, Singapore, is heard now only on 6.135 and 4.785, in native. FEBS, Singapore, noted 0415-1100 on 15.30, 11.88, 11.69, 6.175, news 1045; sign-off is 1130. *Pakistan — Radio Pakistan* noted on approximately 11.73 from 0940; news 1015; signs off 1035. *Taiwan*—BED4, 11.735, Taipeh, signs on daily 0430; news 0630; weak to fair signal; 7.133 parallels, both heard as late as 1100; one on 3.22 is heard weakly at 0500, irregularly, and does *not* carry 0630 news; 15.235 and 11.735 are noted 2300-0100 (first hour *English*), news 2303; the 11.735 seems to have Chinese now after 0100 as has been noted signing off 0200 in Chinese. *USI*—YDE, 11.77, Djakarta, noted signing on 0430; has *English* 1000-1100, news 1030; YDQ2, 9.55, Makassar, signs on 0400; YDB3, 7.27, heard weak to fair after 0430, still on 1045; YDF, 6.045, signs on 0430, fine signal; off 1030; *no English noted* on 6.045. *USSR*—Petropavlosk, 6.07, now heard only 0300-0400 in Russian, 0530-0615 in Chinese, with 4.275, 8.82 parallel in Chinese period; Moscow noted on 6.055, with 6.115 and 9.545 parallel, signing on 0230 and off 1000, with Chinese and Japanese programs; 11.83 heard signing off in Chinese 1000; Home Service, 9.37, 9.565, 5.94, 5.72, 5.02V, 4.96, noted after 0230; irregularly, 9.565, is heard in Chinese also around 0300.

Fox, N. Z., asks help in identifying a station on 3.960 from around 1430; has piano note interval followed by "bird whistle" at 25 minutes after the hour and 5 minutes before the hour; language appears Italian. However, Cushen, also N. Z., appears to hear the same station but lists frequency as 3.910 and says he believes it is *Radio San Marino;* programs are similar to those of *Radio Andorra* and *Radio Monte Carlo;* noted from before 1300 to fade-out around 1500; at 1400-1430 has frequent commercial announcements interspersed with brief musical items; 1300-1400 uses French, and from 1400 is in Italian. (Radio Australia)

Radio Pakistan, Lahore, has been logged on 4.810 at 1015 when relays news from Karachi.

Lourenco Marques, Mozambique, is noted in 60-m. band daily with *English*, parallel 11.764, around 2300-2400 or

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.25	10,000	14F192	19.50
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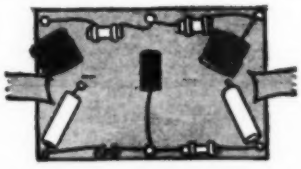
1	440 AC	KG4010	.59
1	2,500	482616-10	2.55
1	3,000	A1089	2.75
1	3,600	C8B3062	2.95
1	5,000	23F49-G2	3.15
1	6,000	T60010GA	4.35
1	12,000	26F628	9.50
2	440 AC	67x21	.79
2	600	A14109-2	.85
2	1,000	23F11	1.10
2	2,000	324-138	2.20
2	3,000	2538-16	4.50
2	5,000	G-8B2784	6.50
2.5-2.5-5	600	C8B1256	1.95
4	330 AC	KG3040	.85
4	400	25F785	.95
4	600	B8B1253-1	1.10
4	1,000	10365	1.75
5	1,000	13765	1.85
6	330 AC	67x7A	.89
6	44 AC	K64060	.95
6	600	P9718	1.75
8	1,000	143-117	2.50
8	2,000	TJU20080G	4.95
10	400	7DB1AE1D	1.25
10	600	10373	1.85
15	1,000	23F19G2	3.95



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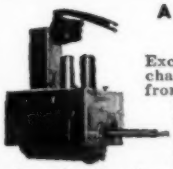

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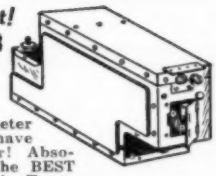

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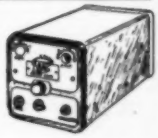

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later; frequency is listed 4.932 but seems as low as 4.913 at times.

DZH5, 9.690, "The Voice of the Catholic Philippines," University of Santo Tomas, Manila, was acquired from the Philippine Broadcasting Corporation on Sept. 17, 1950; staff consists of amateurs from the University and the station is non-commercial, existing for cultural, educational, and training purposes. DYH4, 6.055, broadcasts missionary programs 0500-1000 and is operated by Sillman University in Dumaguete City. (Cushen, N. Z., via *WRH* Bulletin)

ZNX32, Bridgetown, Barbados, used only on occasions to relay sports events, was heard recently on measured 7.547, closing down 1635. SABC's 25-m. outlet announced as 11.927 has been measured as 11.938 around 1430-1505 when closes. Although *Pan-American Radio,* Tangiers, announces 15.048, it has been measured 15.038 when signing off tests at 0832. (Catch, England)

"The Short-Wave Station Free Russia," clandestine, operates on 45 meters daily 0630-0700; programs in Russian and German are dedicated to Underground organizations in the Red Army and in the Russian Zone of Germany.

APK3, 11.884, Karachi, Pakistan, noted with native music and leaving the air suddenly, without announcement, at 2125. ZBW3, 9.524, Hong Kong, noted with weather report 1029 and closing down with "God Save the King." (Russell, Calif.)

HI9B, 6.000, can be heard 1100-2030 in Spanish; QRA is HI9B, Broadcasting Hotel Mercedes, Santiago de Los Cabelleros, Dominican Republic. (Kroll, N. Y.)

Radio Eirrean, Dublin, "says" it is on 15.120 at 1710 and on 17.840 at 1330 with news; however, only the 1330 period on 17.84 is heard. (Peddle, Newfoundland)

Flavio Serrano, *ISW* monitor in Rio de Janeiro, is now employed by *Radio Quitandinha,* Petropolis, Brazil, in charge of correspondence between the station and its listeners; wants more reports from USA, with numerical ratings even if reception is poor. Serrano says *Radio Nacional,* Rio de Janeiro, has a QSL card (sent along a sample) and wants reports; says an IRC is not necessary; when the *new* 50 kw. s.w. transmitter comes on the air in late 1951 or early 1952, the *English* program will be resumed; due to reduced QRM from Moscow on 9.72, PRL7 will remain there instead of moving to 9.505, as indicated earlier.

The *new* Chilean, CE1515, 15.15, is scheduled irregularly; heard as early as 0700 and as late as 2200; is *"Radio Corporacion."* (Serrano, Brazil) Has good signal in U.S.A.

Moscow frequencies now used to North America evenings are 11.89, 15.23, 9.76, 9.67, 7.28, 7.25, according to announcement; 6.010 has been dropped and 7.290 is not in use until 2100; others are used 1820-2300; the "Moscow Mailbag" is Saturdays 2100-2130. (Grischott, Calif.)

Springbok Radio, 4.945, South Af-

rica, is being heard by Stark, Texas, and by myself in West Virginia around 2330 with commercial announcements, 3-note gong which is used frequently; fair level; uses *English* normally but may take Afrikaans on occasion. Should open 2300.

Radio Nigeria, Lagos, Nigeria, is scheduled weekdays 0100-0215, 0600-1700; Sundays 0100-1700; frequencies are listed 6.035, 7.255, 9.655. (Fairs, England, via *WRH* Bulletin) It is doubtful that the three frequencies are used simultaneously.—KRB.

Radio Monte Carlo, 6.035, 9.785, again opens daily 0100; usually closes 1710 but some days runs to 1735; normally, there is a break (silent period) around 0820 to 1145 or 1200.

TFJ, 12.175, Reykjavik, Iceland, is still heard with native program on Sundays *only* 1115-1145. (Sutton, Ohio)

JKL, 4.860, AFRS station in Tokyo, noted ending news 0630, then music. (Oskay, N. J.)

Radio Tupi, ZYC9, 15.370, Rio de Janeiro, noted 1909-1930, weak; distorted at intervals; frequent announcements in Portuguese. (Patterson, Ga.)

According to various sources, these countries or territories are reported to keep some form of "summer" or "daylight-saving" time (*i.e.*, clocks are advanced 1 hour from Standard Time)—Albania, Balearic Is., Bermuda, Brazil (around Dec.-March), British Columbia, Canada (varies locally), Chatham Is., China (varies), Dominican Republic, Eire, French Morocco, Gambia, Germany, Gibraltar, Gold Coast (½ hour from Sept. 1 to Jan. 1, annually), Hong Kong, Hungary, Iceland, Ireland (Republic of), Israel, Japan, Korea, Lebanon, Libya, Monaco, Morocco (International Zone of), Newfoundland, Peru (Lima and Gallaeo area from Jan. 1 to March 15, annually), Poland, Portugal, South Africa, Spanish Morocco, Syria, Turkey, United Kingdom, and United States (some areas; varies locally). (Allen, Mass.)

Union Radio, Havana, noted on approximately 8.880 now. Belize, British Honduras, is noted irregularly on approximately 4.965; news around 1925. *Radio* Tananarive, 9.695, Madagascar, is now audible after 2230; also noted from 2230 on 9.515. (Stark, Texas)

A station identifying as "Radio Internacional de Guatemala" has been heard on 6.260 at 0230-0300 with popular Latin and American dance music; fair signal; no location given; Hong Kong, 9.525, noted with BBC news relay from London 0600; *Radio Pakistan*, 15.335, has news 2100, fair level. (Rosenauer, Calif.)

YNWA, 6.460, 5a. Calle N.O.Y. 5a. Av., Managua, Nicaragua, verified via airmail; card is red, white, and blue. (Gerran, N. Y.)

* * *

Acknowledgement

Thanks for the fine cooperation during the winter DX months; please keep your reports coming to me during the summer—at 948 Stewartstown Road, Morgantown, West Virginia, U.S.A. Thanks again! . . . . . KRB.

MARS Station of the Month

MARS BEAMS WEEKLY BROADCASTS

MARS—Army Headquarters station, WAR, located at the Pentagon Building, Washington, D. C., broadcasts a weekly message each Tuesday at 0100Z and at 0400Z. (This is Monday at 8 p.m. and 11 p.m., Eastern Standard Time; Monday at 7 p.m. and 10 p.m., Central Standard Time; Monday at 6 p.m. and 9 p.m., Mountain Standard Time; and Monday at 5 p.m. and 8 p.m., Pacific Standard Time.)

Simultaneous broadcasts are made on frequencies 3497.5 kc., 6997.5 kc., 14,405 kc., and 20,994 kc. Each message is sent three times, once at 10 words per minute, once at 15 words per minute, and once at a higher rate of speed—usually 20 words per minute.

Designed especially to transmit quasi-official traffic and training information to MARS members, the broadcast offers an excellent opportunity for all amateurs to build up their code proficiency.

THE second annual Armed Forces Day will be observed May 19, 1951. The Army, Navy and Air Force have jointly arranged a special program for the radio amateur fraternity.

A receiving competition, identical with the one held last year will feature a message to the amateurs from the Secretary of Defense, broadcast on 12 military frequencies in International Morse Code, at 25 words-per-minute. Any listener may copy the broadcast and mail it to *ARMED FORCES DAY CONTEST*, Room 2B313, The Pentagon, Washington 25, D. C. All who make perfect copies will receive a Certificate of Merit, attesting their code copying proficiency. The following times, call letters and frequencies will be employed for the Receiving Competition (Eastern Standard Time has been used throughout): 2000 EST—AIR (Air Force Radio, Washington, D. C.), 14,405, 20,994 kc.; NSS (Navy Radio, Washington, D. C.), 122, 4390, 9425, 12,630, 17,000 kc.; WAR (Army Radio, Washington, D. C.), 3497.5, 6997.5 kc. 2400 EST—AIR (Air Force Radio, Washington, D. C.), 14,405, 20,994 kc.; NPG (Navy Radio, San Francisco, Calif.), 115, 9255, 12,540 kc.; WAR (Army Radio, Washington, D. C.), 3497.5, 6997.5 kc.

Each transmission will be preceded by a five-minute CQ call. Should characters for any reason be transmitted with improper spacing, such as tape-punching errors, etc., such errors should appear in your transcription. It is not necessary to copy more than one station; no extra credit can be given for so doing.

Military-to-Amateur Test

The Headquarters stations for the Army, Navy, and Air Force (WAR, NSS, AIR) will operate for a six hour period (1800 EST to 2400 EST) just

Major Lynn A. Breece, W5HFB, and T/Sgt. Chris Russell, W5SKK, are key personnel at the two MARS stations at Barksdale Air Force Base, Shreveport, La. K5AIR is Hdqts. 2nd Air Force and K5FBI is the 91st Air Base Group station. Both stations have BC 610's. K5AIR uses a long wire, K5FBI has a Johnson 10 and 20 meter rotary beam.

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0Z4M	.89	5X4G	.89	6GJ	.59	12AT6	.79	35Z3	.99	1LH4	.99
1A3	.69	5Y3GT	.69	6H6GT	.89	12AT7	1.69	35Z4GT	.89	1LN5	.99
1A4P	.39	5Y4G	.79	6H6M	.89	12AU6	1.19	35Z5GT	.89	3LF4	.99
1A5GT	.79	5Z3	.89	6J5GT	.69	12AU7	1.49	36	.69	7A4(XXL)	.79
1A6	.39	5Z4	1.09	6J6	1.69	12AV7	1.69	37	.69	7A5	.99
1A7GT	1.09	6AB4	1.09	6J7GT	.69	12AX7	1.39	38	.69	7A6	.79
1B3/8016	1.49	6AC5GT	.99	6J8G	.89	12BA6	.99	39/44	.69	7A7	.79
1B4	.49	6AB5/6N5	1.29	6K5GT	.79	12BA7	.99	41	.99	7A8	1.09
1B5/25S	.49	6AC7	1.69	6K6GT	.79	12BD6	.99	42	.99	7AF7	.79
1B7	.59	6AE5	.99	6K7GT	.69	12BE6	.99	43	.99	7AG7	1.09
1C5GT	.99	6AE6	.79	6K8GT	.79	12BF6	.69	45	.99	7AH7	1.09
1C6	.39	6AF5	.89	6L6	.49	12BH7	1.39	45Z3	.89	7B4	.79
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1D7G	.49	6AH5	1.49	6L6M	1.99	12H6	.79	47	.79	7B7	1.09
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1E5	.49	6AJ5	1.49	6N6	1.89	12J7GT	.89	50A5	1.19	7C4	.69
1E7	.49	6AK5	1.99	6N7GT	1.19	12K7GT	1.09	50B5	1.19	7C5	.79
1F4	.39	6AM6	1.19	6P5GT	.79	12K8GT	.79	50C5	1.09	7C6	1.09
1F5G	.49	6AL5	1.19	6Q7GT	.79	12Q7GT	.79	50L6GT	1.09	7C7	1.09
1F7	.49	6AQ5	1.19	6Q7G	.79	12SA7GT	1.19	50Y6GT	.99	7E4	.79
1G4GT	.49	6AR5	.89	6R7G	.69	12SC7	.89	52	.99	7E5	.89
1G5	.49	6AR6	.99	6R7GT	.69	12SF5GT	.59	53	.79	7E6	.89
1G6G	.69	6AS5	1.19	6S4	.99	12SF7M	.69	55	.89	7E7	.89
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1H5GT	.79	6AU5	1.59	6S8GT	1.29	12SH7M	.99	57	.69	7F8	1.59
1H6	.49	6AU6	1.19	6SA7GT	.99	12SJ7GT	.89	58	.79	7G7	.99
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2A5	.59	6BC5	1.19	6N7M	1.19	25B6G	1.99	117L7/M7	2.29	14B6	.89
2A6	.49	6BE6	.99	6T7G	.79	25C6	.89	117N7GT	2.29	14B8	.99
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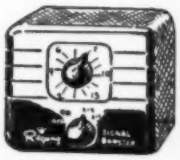

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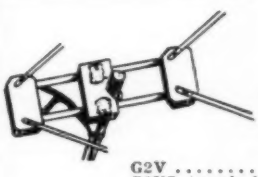

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—30—

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—30—

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LANCASTER Allwine & Rommel Registered Patent Attorneys. Patent practice before U.S. Patent office. Validity and Infringement investigations and opinions. Booklet and form "Evidence of Conception" forwarded upon request. Suite 414, 815 15th St., N.W. Washington 5, D.C.

HERMAN Lewis Gordon. Registered Patent Attorney. Warner Building, Washington, D. C.

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MISCELLANEOUS

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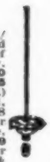
INDEX OF *Advertisers*

MAY 1951

[While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.]

UHF ANTENNA



UHF ANTENNA 12"/30CM ATS/ARR1 Usable Citzn & Ham Band Ins Coax Term Silv Pl Cont Wpf Gask & H'ware Mobile Mtg. New. **39c; 4 for $1.00**
PL259 for above .... **.65**
TV CONICAL ANTENNA (Dubl-X) Sturdy Prefab Const Versatile 72, 150 or 300 ohm Match. Incl 8 elements & 100 ft. All-Copper Twinex, Cross Bar & Hd'ware, Brand New. Only **$8.49**
Dubl-Stacked Conical Array Similar above, but with 16 elements & all hardware plus 2 crossbars & 100 ft. All-Copper Twinex, Brand New **$12.98**
MICROWAVE ANT AS125/APR, 1000 to 3400Mc w/UG58U Term InBuilt HiPass Fltr Flange Mtg Incl H'ware, SPECIAL .. **$3.98**
ANT AN130B, 33" Whip .... **.98**
ANT AN131A, 11 ft. 8 sect **2.89**

Sectional Antennas
MS49-52, 12½ ft. **$1.69**
MS49-53, 16 ft. **2.49**
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MAST BASE for MS-53 .... **2.25**
BASES: MP22, $2.85; MP48 .... **2.85**
GE-2J1G1 Selsyns, You Fix 'Em, As Is. No Returns .... **2 for 49c**
GE-2J1H1 Selsyns, Exc. Cond. . **2 for $6.98**

PRECISION RESISTORS

Over 2½ Million in Stock
"TAB"—Specialists in Precision Resistors
No Mfrs Choice—We Ship Types in Stock

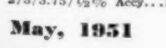
0.116	418.5	1712	6140	8250	57065
0.42	425	1740	6160	8263	58333
0.425	426.9	1770	6175	8300	60000
0.607	427	1800	6180	8410	61430
0.7	440	1818	6190	8420	62000
1.03	450	1830	6200	8490	64000
1.3	452	1865	6210	8500	65000
1.75	460	1892	6220	8550	66600
2.5	470	1894	6230	8650	66650
3	475	1895	6240	8700	67500
3.83	478	1896	6250	8710	68000
4	480	1897	6260	8765	70000
4.35	487	1898	6270	8770	72000
5	500	1899	6280	8800	73500
5.025	510	1900	6290	9000	75000
6.25	520	1901	6300	9100	80000
6.5	525	1902	6310	9445	82000
7	540	1903	6320	9500	84000
7.8	550	1904	6330	9710	85000
7.9	560	1905	6340	9800	85750
8	575	1906	6350	9900	88000
10.38	580	1907	6360	9902	90000
11.25	588	1908	6370	10000	91000
12	600	1909	6380	10430	93300
13.52	610	1910	6390	10500	95000
14.2	612	1911	6495	10600	100000
14.25	620	1912	6500	10900	110000
14.5	625	1913	6510	10936	115000
15	630	1914	6530	11000	116667
16	633	1915	6540	11400	120000
17	640	1916	6550	11500	130000
19	641	1917	6560	11690	135000
19.2	645	1918	6570	12000	140000
20	649	1919	6580	12500	141000
22	650	1922	6590	12800	145000
23	657	1924	6800	13000	147000
24	660	1926	6820	13100	150000
25	665	1960	6840	13500	155000
26	668	1980	6860	13550	160000
28	670	2000	6880	13600	165000
30	673	2045	6890	14000	166750
31.5	675	2080	6930	14250	167000
37	680	2095	6950	14400	169200
48	681	2141	6960	14500	175000
49	684	2142	6970	14550	180000
50	689	2145	6980	14600	180600
51.78	690	2150	6990	15000	185000
55	697	2160	7000	16000	186600
56.7	699	2180	7010	16500	190000
60	700	2187	7020	16800	198000
63	710	2195	7030	17000	200000
68	711	2200	7040	17500	201000
74	720	2250	7050	17977	205000
75	730	2300	7060	18000	210000
80	733	2400	7070	18300	215000
81.4	740	2450	7080	18380	220000
88	750	2463	7090	18500	225000
89.8	760	2485	7100	18800	229000
95	770	2490	7110	19000	230000
100	780	2500	7120	19500	235500
101	790	2525	7125	20000	238000
105	800	2600	7140	20441	240000
105.7	806	2625	7150	20500	245000
107	810	2635	7160	21000	250000
120	820	2700	7180	21500	265000
121.2	830	2750	7200	22000	268000
125	840	2850	7240	22500	270000
130	850	2860	7260	22990	275000
135	854	2870	7290	23000	294000
147.5	860	2900	7300	23150	300000
150	870	3000	7320	23325	307500
160	880	3100	7350	23400	311000
165	890	3163	7360	23500	314000
170	899	3259	7375	24000	316000
175	900	3290	7380	24600	325000
179	910	3333	7385	25000	330000
182	917	3384	7390	25200	333500
182.4	920	3500	7400	25400	350000
200	930	3509	7420	25833	353500
209.4	940	3700	7440	26000	375000
216	946	3730	7460	26500	380000
220	950	3760	7480	26600	400000
220.4	960	4000	7500	27000	402000
225	978	4030	7520	27500	420000
230	1000	4200	7540	28000	422000
235	1030	4220	7570	28430	425000
240	1056	4280	7580	28500	450000
245	1059	4300	7600	29000	458000
245.4	1067	4314	7610	29500	478000
250	1100	4440	7630	29990	500000
260	1110	4444	7650	30000	520000
271	1150	4500	7680	31000	521000
275	1155	4720	7700	31500	525000
280	1162	4750	7710	32000	543000
286	1200	4850	7717	33000	550000
289	1225	4885	7725	35000	570000
299	1250	4900	7740	37000	575000
300	1260	5000	7760	38140	600000
310	1300	5100	7770	38500	620000
311.5	1350	5210	7800	39000	650000
320	1355	5235	7820	39500	654000
325	1400	5270	7835	40000	660000
330	1488	5300	7840	42000	690000
340	1495	5500	7850	43000	700000
350	1500	5600	7860	45000	750000
360	1510	5730	7880	......	761300
366.6	1518	5770	7900	47500	800000
370	1600	5910	7930	48000	813000
375	1640	6000	7950	48660	850000
380	1646	6100	8000	49000	900000
389	1650	6110	8094	50000	930000
390	1670	6120	8140	52000	950000
400	1680	6125	8160	55000	......
410	1710	6130	8225	56000	
414.3			8240		

Any size Above, Each 35c; Ten for $3.29

MEGOHMS

1.	1.57	2.25	3.673	6.	8.02
1.1	1.579	2.5	3.75	6.5	8.5
1.2	1.65	2.7	3.9	6.6	9.05
1.25	1.75	2.75	4	6.7	9.5
1.3	1.8	2.8	4.23	7	10
1.35	1.9	2.855	4.25	7.5	11.55
1.39	2	3	4.5	7.62	12
1.4	2.11	3.3	5	7.74	12.83
1.5	2.2	3.5	5.5	8	13
					13.85

Any Size Above, Each 70c; Ten for $6.49



Vacuum Precision HiVolt Resistors
Megohms—.12/.25/.6/.75/.83/.99/1/1.5/2/3/3.75/½% Accy...Ea. **$1; 10/$7.50**

RECTIFIERS

30Vin/26Vout/150Ma Selen w/mtg flange. 2 units can connect in C. T. for Full Wave; 4 units usable as Full Wave Bridge. Ea. Unit, **36c; 2 for 60c; 4 for** **$1.00**
Sensational BRADLEY Double Bridge. Balanced Current & Temp 1% from −40° to +68°C. Inpt to 4.5VAC, Output to 3VDC/5Ma. Only **98c**
Full Wave Bridge Selen for relays or Pwr, Inpt 115 to 130 vac; Outpt 115vdc/40Ma. **Ea. 69c**; 10 for **$5.98**
Copper Oxide V'Dblr Watghs 15Vin/30V out/100Ma **98c**

SELENIUM RECTIFIERS

Volts In	Volts Out	Amps.	Each
HALF-WAVE			
18	12	.15	$ .69
130	120	.075	.59
130	120	.09	.69
130	120	.2	.98
130	120	.225	1.29
216	144	.075	1.75
FULL-WAVE CENTER-TAPPED			
36	28	1.5	2.30
FULL-WAVE BRIDGE			
18	14	1.5	$2.29
18	14	2	2.45
18	14	4	3.98
18	14	8	5.98
18	14	12	7.98
18	14	24	15.95
36	28	1	3.69
36	28	3.5	4.98
36	28	10	13.95
56	32	2	4.98
90	60	.15	2.85
120	100	1	8.98
130	120	2.4	12.29

HAYDON CLOCK MOTOR and SWITCH

Synchronous 6 to 10 VAC/60cy/24RPM & Switch op110V/60cy w/Resistor, **98c; 12 for $10.00**
Reversible Clock Motor SYNC 2 RPM/115V/60cy **$4.95**
Clock Motor SYNC 3½ RPM/115V/60cy **$2.49**
Clock Motor SYNC 5 RPM/115V 60cy **3.49**

LINE FILTERS

10Amp/130vacdc Csd USN 0.1 to 1000 Mc's **$1.29**
30Amp/250vacdc Csd USN 0.1 to 1000 Mc's Ea. **$3.98; 2 for $6.00.**
50Amp/600vdc/250vac. Fltrs both sides of line. SOLAR "Elim-O-Stat." New **$9.98; 2/$18; 5/$39.**
100Amp/usable 110 vacdc GE, SPECIAL **2 for $1.98.**

MICA CAPACITORS

Brand NEW Made to Rigid Gov't Specs.

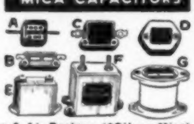


Fig. A. Postage & ½ Postage (*Silver Mica)

Mfd.	Each	Mfd.	Each
.000015*	$0.17	.0011*	$0.17
.00002	.09	.0012*	.23
.000022	.09	.002	.15
.000024*	.17	.00224*	.27
.000025*	.17	.0025	.15
.00004	.09	.003	.17
.00005*	.17	.003/1KV	.29
.000082	.09	.0033*	.35
.0001	.09	.004	.22
.0001*	.17	.004*	.43
.0003	.09	.005	.23
.001*	.17	.006	.23
.0011	.09	.01	.29

Fig. B. .001 mf. **10c**; .006 mf, **23c**; .01 mf, **35c.**

Fig. C. Solder Lug Terminals & Mtg Holes

Mfd.	Ea.	Mfd.	Ea.
600 WV		**600 WV**	
.0001	$0.29	.02	$0.78
.001	.42	.03	1.19
.002	.45	**1200 WV**	
.004	.53	.002	.66
.005	.55	.004	.68
.006	.59	.005	.71
.008	.63	.01	.78
.01	.66	**2500 WV**	
		.00047	.59

Fig. D. Screw Term & Mtg

Mfd.	Ea.	Mfd.	Ea.
600 WV		**1200 WV**	
.0001	$0.29	.01	$0.78
.00055	.37	.013	.89
.00085	.42	.03	1.89
.0012	.44	.033	2.39
.003	.49	**2500 WV**	
.005	.54	.0004	.59
.015	.71	.002	1.09
.02	.78	.0022	1.09
.03	1.19	.0035	1.19
.033	1.29	.0036	1.19
.039	1.98	.0043	1.29
.04	2.09	.005	1.45
.05	2.39	.006	1.55
1200 WV		.01	1.89
.001	.61	.015	2.19
.002	.66	**3000 WV**	
.0051	.71	.005	1.65
.0068	.75		

Fig. E. Upright Xmtg Micas

Mfd.	Each	Mfd.	Each
250 VDC		**3000 VDC**	
.05	$0.47	.0055	$1.65
.2	2.59	.008	1.79
1500 VDC		**3500 VDC**	
.04	.89	.000033	.78
.05	1.08	**5000 VDC**	
2000 VDC		.000082	1.65
.003	1.08	.0001	1.79
.005	1.19	.00015	2.29
.006	1.25	.00018	2.39
.01	1.39	.0002	2.49
.015	1.68	.0003	2.75
.02	1.98	.00043	2.85
.03	2.35	.0006	3.59
2500 VDC		.001	3.89
.0025	1.08	.005	4.29
.006	1.65	.01	4.79
3000 VDC		**6000 VDC**	
.00005	.78	.001	4.29
.0001	1.08	.002	4.79
.0003	1.15		
.0007	1.19		
.005	1.65		

Fig. F. Heavy Duty, Upright, Bklte Csd

Mfd.	KV	Each	Mfd.	KV	Each
.01	5	$10.95	.0003	8	$3.98
.003	6	5.59	.0025	8	5.59

END EQUIPMENT BUYS!

US Navy Version BC645 Ideal Citizens Band Conversion, NEW, less tubes, connector & Dyn **$12.95**
RADIO COMP RCVR Less Tubes, AsIs **5.98**
TGS Keyer, As Is **5.98**
EE8 RingingGen Assy, Like New, Less Handset(TS-9), **$7.98**; Handset forEE8 **4.98**
R9/APN4 Receiver, Less Tubes, As Is **14.98**
TG10 Code Unit, Less Tubes & Cabinet, as is **19.95**
B19-M4 Variometer Unit, As Is **1.98**
RM29 Control Unit, BRAND NEW .. **11.98**
RT34/APS13 30 Mc IF, Less Tubes, As Is **7.98**
R59/TPS3 Good, As Is, Less Tubes. **29.98**
EE65 Telephone Test Set, Fine Cond. **24.98**
BE65 Time Interval Signal, Used... **3.98**
R74/CRW Rcvr, Less Tubes, As Is .. **2.49**
I-81 Compass Indicator **7.95**
I-82 Compass Indicator **4.95**
R89/ARN5A less tubes, CAA app. vd **19.98**
PE97 Plate Supply Unit, Less Tubes **9.98**
I-108 Range Calibrator, Metal Case. **29.98**
PE120 Pwr Supply, Less Tubes, Used **9.98**
Mackay 168B Radio Xmitter, w/Metal Case, Less Vibrapack & Tubes, As Is **2.98**
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BC212 Amp, Exc Cond, Less Tubes. **1.49**
M299 Mike Adapter, Good Cond .... **.69**
BC453 Rcvr (190-550Kc) New **24.49**
BC454 Rcvr (3-6 Mc) New, Less Tubes **10.49**
BC455 Rcvr (6-9Mc), LT*, Dyn, As Is **4.95**
BC456 Mod, Less Tubes*, Dyn, As Is **1.98**
BC457 Xmtr (4-5.3Mc), LT*, As Is .. **3.49**
BC458 Xmtr (5.3-7Mc), LT*, As Is .. **3.98**
SCR595 IFF, Less Tubes, As Is **3.98**
BC602 Cont Box for 522, As Is **1.29**
BC605 Amp, Less Tubes, As Is **3.98**
SCR695 IFF, Less Tubes, As Is **4.98**
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BUILD A BANTAM 1-WATT XMITTER

FOUNDATION UNIT
Free Instructions. Takes 2 plug-in FT-243 Xtals & Coil, W/140mmf Cndsr & Xtal Socket .... **2 for 49c**
Complete with Xtals & Coil .... **2 for $1.69**

KITS.....

Silver & Mica Cndsrs .... **30 for $2.50**
Controls, 50 ohm to 2 Megs .. **10 for 2.98**
Resistors, ½&1W, to 2 Megs. **100 for 5.98**
Vitreous WW Resistors .... **5 for .69**
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Rotary Switches, Asstd .... **6 for 1.75**
G&P Tube Caps, Asstd .... **50 for 1.49**
Coil Forms, Th'd Sm HF .... **50 for 1.00**
Iron Core Slug & Screw .... **50 for 1.00**
Elastic Stop Nuts, Asstd .... **50 for 1.00**
Knobs, Asstd, w/Insert .... **10 for .98**
Spaghetti Sleeving, Asstd .. **75 ft. for 1.00**
Ceramicon Cndsrs, Asstd .... **12 for 1.00**
Fuses, Asstd, LF & Buss .... **75 for 1.95**
Grommets, Rubber Asstd .... **50 for 1.00**
Resistors, 2 W Asstd .... **25 for 3.98**
Tie-Point Lugs, Asstd .... **35 for .98**

Alignment Tools

(Top) **Ideal NO-LOSS Alignment Screwdriver TL150**, long Insulated Shaft, Sure-Grip Knurled Knob, Only **49c**
(Bottom) **RELAY Spring Adjuster &** Switch-Bd Tool Slot takes up to .022", WEC No. 293 .... **98c**

810 Watt Powerstat

230V, 50/60cyc, 1ph Input No. 216U: Brand new Bench or Wall mtg. Output: 0-270 Volts, 3 amps, 810VA. Can operate from 115volt single phase source to deliver 0-270 Volts output—UnCsd, Less Cord. Complete with Knob, Dial Plate & Instructions, 11 lbs **$19.95**

TUBE SOCKETS, ALL TYPES

A. RCA 5-pin GIANT, 803, etc **$1.49**
B. Johnson 4-pin Bayon, 866, etc .... **.85**
C. 304TL Socket **1.15**
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J. 5-prong STEATITE Johnson, 807 .... **.30**
K. 7-pr STEAT Johnson, 1625 .... **.36**
L. 7-pin NATIONAL CIR7L Steatite ..... **.30**
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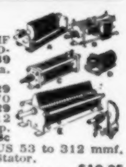
M. MINI 7-pin Mica 'B Top Mtg&½Shld B **.23**
M. MINI7-pinBotMtgBkltSimAmph147-500 **.13**
M. NOVAL9-pinMini.½ShldBase,TopMtg .. **.45**
M. NOVAL 9-pin Min, ½ Shld, Top Mtg. **.45**
M. NOVALShld.1½", **12c**;1-15/16"or2⅜" **.14**
N. AMPH fem 78F Pin 4,5,6,8 .... **.17**
O. 4-pin AMPH49RSS4 & mtg. Ceramic .. **.27**
P. OCTAL 8-pin & plate Bklte .... **.10**
Q. OCTAL 8-pin & plate Steatite .... **.25**
Q. OCTAL 8-pin & plate Mica 'B .... **.11**
R. LOKTAL 8-pin & lock Mica 'B HF .... **.10**
S. KLYSTRON socket Cinch .... **.35**
T. LOKTAL Amph 49SSL Steatite .... **.30**
U. OCTAL Amph 78S8 mica Bklte .... **.09**
U. 11-pin 78S11/931 Amph .... **.16**
V. OCTAL Amph 49SS8 steatite .... **.25**
W. HiV Safety 4-pin Amph 77A4 .... **.39**
Y. MAGNAL 49SS11L ceramic, 5BP1, 5BP4 **.69**
SOCKET FOR 872/211 .... **.59**
SOCKET Ceramic 4-prong Silv. Pl. sim. JOHNSON 122-244 for 8008, C6J, 5C22, 575 **1.20**
MYKROY HiV Safety Sckt 866 .. **98c; 2 for 1.49**

"TAB" THAT'S A BUY

VARIABLE CONDENSERS



A. 150mmf/300VGap HF MILLEN, CARDWELL **$1.39**
B. BUD Dual 75mmf ea. Sect 1000V Gap, HF **$1.29**
C. JOHNSON 70H30 70 mmf/3000V Gap. **$1.29**
D. Cardwell Neut ZT/12 mmf 500 Volt Gap, w/Locknut **98c**
E. CARDWELL TK-300-US 53 to 312 mmf, Can be made Split Stator, BRAND NEW **$10.95**
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Midget 3 to 15 mmf, Midline, each **39c**
Phasing Condenser 90 Degree Quadrants, 4 Taps, 360deg Sinewave Gen **$4.98**
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KLAKS SPECIAL! Brand New Sandals for Shower or Beach, Sturdy Wood & Canvas Constr, Popular Size 10, Pair **39c**

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Complete Pwr Supply w/cndsrs, Lamp, data 115 VAC **$29.95**
Studio Kit Air C 1169 set 115 VAC or Batt, 2 Lamps **$69.95**
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PHOTOFLASH CONDENSERS
15mfd/330vac/1800vdc INT **$3.98**
25mfd/330vac/1800vdc INT **6.49**
16mfd/600vac/2800vdc INT **6.98**

R4340 Sylvania Electro Flash Lamp. A $57 Seller, BRAND NEW .. **$36.00**
X-400 Air Corps Lamp **14.98**
Hi-V P'Flash Pwr Kit. Ideal 1800V Dblr Ckt: 115vac Inpt: Output 900V/35ma & 2x2.5v/2Aea wndg/4KVins Sig Cspec H'Sld PLUS 2x25mfd/90W-See Cndsr & Data for Flash .. **$18.98**
Above w/Flash Lamp **$28.98**

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No.	Similar to	Each
U10	G-E FT114	$11.79
No. 1	AMGLO 5804X	11.98
23ST	G-E FT110	10.98
53GT	G-E FT403	16.98
VA	SYLVANIA 4330	12.98

I-F TRANSFORMERS

456 Kc Double Slug Tuned, Shielded .... **3 for $1; 8 for $2**
10 to 14Mc FM&TV Double Slug Tuned, Shld'd. **2 for $1; 5 for $2**
2.2 to 2.7Mc COLLINS/USN Slug Tuned Coil, 5 prong Mtd. **4 for $1**
8.15 to 10Mc Double Slug Tuned, Shielded, Incl 2 Silv P16-25mmf Ceramic Trimmers, 6 Ceramicons & 3-AB Resistors **99c**

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UTC 854, 1024, 1250 cys ea. **$1.95** .... **3 for $4.50**

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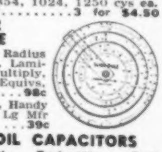

12" Equiv—2⅛" Radius PRINT STAYS ON, Laminated Plastic, Multiply, Divide, Logs, Dec Equivs, Case **98c**
PARALLEL RULES, Handy Drafting Tool, 6" Lg Mfr BRUNING **39c**

OIL CAPACITORS

Mfd	Each
25wvdc	
50	$6.98
50wvdc	
4	.49
150wvdc	
1-1-3-5	.69
250wvdc	
1	.39
2x.25	.35
300wvdc	
1.2	.39
400wvdc	
.1	.49
.25	.55
.5	.59
1	.69
4	1.69
6	2.29
8	2.49
10	2.89
2x.1	.75
2x.5	.94
3x.1	.91
3x.25	.99
600wvdc	
.034	.49
.1	.64
.2	.69
.25	.71
.5	.75
1	.85
2	.99
3	1.08
4	1.89
5	2.29
6	2.69
7	2.89
10	3.29
2x.1	.79
2x.25	.85
2x.5	.95
2x1	1.19
2x2	1.39
2x8	3.49
3x.05	.89
3x.22	.98
3x.25	1.09
700wvdc	
4	1.98
800wvdc	
.1	.69

Mfd	Each
1000wvdc	
.1	.73
.45	.79
1	.99
2	1.69
4	2.29
5	2.98
10	3.98
15	4.98
1400wvdc	
.25	1.29
.5	1.39
1500wvdc	
.5	1.59
.75	1.69
1	1.79
2	2.29
4	2.98
5	3.49
6	3.98
24	8.98
2000wvdc	
.1	1.49
2x.1	1.75
1	1.98
2	2.49
3	3.98
4	4.49
5	5.39
8	9.49
2500wvdc	
.25	2.29
3000wvdc	
.1	2.49
.5	2.98
2	4.49
3	5.39
4	6.49
4000wvdc	
2	8.98
5000wvdc	
.2	4.49
2	10.98
4	19.98
5500wvdc	
2	12.98
7000wvdc	
.002	1.69
.0075	1.98
.1	4.98
7500wvdc	
.03	2.98
.05	3.49

Mfd	Each
10000 wvdc	
.03	3.49
12000 wvdc	
.02	4.98
12500 wvdc	
.65	16.98
2	95.00
15000 wvdc	
.0016	9.98
25000 wvdc	
.00025	7.49
1	95.00
AC RATED	
220vac/600dc	
2	.69
4	.89
5	1.29
225vac/630dc	
3.3	.79
230vac/630dc	
5	1.29
330vac/1000dc	
1.25	.79
1.5	.89
1.75	.98
2	1.03
2.5	1.09
2.8	1.15
3	1.19
4	1.29
5	1.49
12	3.49
15	3.98
25	6.49
40	9.98
405vac/1200dc	
.15	1.29
600vac/1800dc	
16	6.98
660vac/2000dc	
5	4.49
6	4.98
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"TAB" THAT'S A BUY

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DIODE PROBE TUBE! Unexcelled for NO-LOSS UHF Testing. Ultra-Sensitive Sub-Miniature—Envelope App. 1¼x⅜". Element & Probe at Tip. Low Pwr. Htr. BRAND NEW w/Data. VR92. 23c; 5 for $1.

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SPECIAL—0-15 VAC, 2 1/16" Rd., GE, 800 cyc, USN, NEW....... $1.69

DC MILLIAMMETERS
0-10ma&0-5KV, Basic 1maMVt. 3½". 4.98
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0-7.5V, 3½", Wstghs.......... 2.49
0-8V, 3¼", Weston............ 3.49

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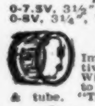

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5" DynSpkr 3000 ohm field HvyDty w/OutptXmfr forPentode From Equip. Like New. Tested, Gtd. $1.39; 4 for....... $5

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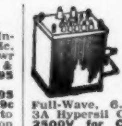
TRANSFORMERS



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570V/150ma 5v/3a, 12v/4a, H'sld.. $4.49
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(Prices Subject to Change)

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OA3/VR75 1.36	2E22 1.12	6AR6 5.49	6Z7G .89	14B6 1.08	EF50 .98
OA4G 1.33	2E24 5.05	6AS5 1.39	6ZY5G .89	14B8 .98	50 1.19
OB2 1.70	2E25A/HY65 5.15	6AS6 2.49	7A4/XXL .98	14C5 1.19	50A5 1.22
OB3/VR90 1.29	2E26 3.85	6AS7G 4.98	7A5 1.10	14C7 1.09	50B5 1.11
OC3/VR105 1.39	2E30 2.25	6AT6 .83	7A6 .85	14E6 1.10	50C5 1.03
OD3/VR150 1.10	2J21 10.69	6AU5GT 1.47	7A7 1.45	14E7 1.33	50C6 1.49
OY4 2.53	2J21A 10.69	6AU6 1.11	7A8 .90	14F7 1.10	50L6GT .94
OZ4 .86	2J26 28.50	6AV5GT 1.47	7AD7 1.56	14F8 1.19	50X6 1.10
C1A 4.90	2J27 28.50	6AV6 .83	7AF7 .97	14H7 1.09	50Y6GT .90
O1A .68	2J31 38.50	6AW6 1.98	7AG7 1.54	14J7 1.23	50Y7GT .99
1A3 1.10	2J32 39.50	6AX5GT 1.25	7AH7 1.15	14N7 1.35	52 .99
1A4P .89	2J33 39.50	6B4G 1.98	7B4 .83	14Q7 1.10	53 .78
1A5GT .85	2J34 39.50	6B5G 1.29	7B5 1.23	14R7 1.19	55 1.06
1A6 1.59	2J36 95.00	6B6G .98	7B6 1.00	14S7 1.33	56 .85
1A7GT 1.14	2J37 12.75	6B7 1.29	7B7 .90	14W7 1.23	57 .89
1AE4 1.50	2J38 23.85	6B8G 1.39	7B8 .90	14X7 1.23	58 .89
1B3/8016 1.47	2J39 38.50	6BA4 1.08	7C4/1203A .79	14Y4 1.20	59 1.78
1B4P .89	2J40 33.50	6BA5 1.98	7C5 1.00	15 .98	RK65 24.95
1B5/25S .98	2J48 28.50	6BA6 1.00	7C6 1.00	15E 2.98	HY69 2.75
1B7GT .98	2J49 39.45	6BA7 1.20	7C7 1.26	15R .98	70A7 1.59
1B21/471A 2.85	2J50 27.50	6BC5 1.11	7C23 72.00	FG17 3.98	70L7GT 1.95
1B22 3.39	2J55 139.00	6BD6 1.11	7E5/1201 1.25	RK18 .98	71A .98
1B23 12.39	2J56 249.50	6BE6 1.00	7E6 .98	18 .98	72 .95
1B24 18.00	2J61 49.50	6BF6 1.49	7E7 .98	19 .65	CRP72 1.37
1B24Syln. 36.00	2K25 49.98	6BG6G 1.95	7F7 1.15	19BG6G 2.98	73 1.67
1B26 3.85	2K25/723AB 49.98	6BH6 1.35	7F8 2.25		NR74 .29
1B27 23.85	2K28/mtd 36.88	6BJ6 1.35			
1B29 2.65	2K29 39.95	6BQ6GT 1.78			
1B32/532A 2.98	2K39 89.50	6C4 .91			
1B36 10.00	2V3G 1.39	6C5GT .83			
1B37 18.00	2W3GT .88	6C6 .89			
1B38 34.00	2X2 .69	6C7 1.26			
1B40 4.95	2X2A 1.59	6C8G .98			
1B41 49.95	3A4 .98	6C21 42.50			
1B42 7.50	3A5 1.69	6CB6 1.11			
1B46 3.69	3A8GT 1.79	6CD6G 2.98			
1B53 49.95	3B4 2.69	6D4 2.85			
1B54 79.95	3B5 .98	6D6 .89			
1B56 40.95	3B7/1291 .69	6D7G .89			
1B59 12.98	3B24 6.98	6D8 .98			
1B60 64.95	3B25 4.60	6E5 1.10			
ELLC 3.49	3B26 3.95	6E6 1.39			
1C5GT 1.09	3B27 1.95	6E7 1.39			
1C6 .79	3B28 7.85	6F5 .83			
1C7G .89	3C6/XXB 1.49	6F6 1.04			
1D5GP .89	3C23 8.95	6F6GT .85			
1D7G .89	3C31/C1B 3.45	6F7 1.39			
1D8GT .98	3C45 13.85	6F8G 1.49			
1E5GP .98	3D6/1299 .69	6G6G .98			
1E7G .98	3D21A 1.98	6H6 .98			
1F4 .69	3E29 17.49	C6J 6.49			
1F5G .89	3LF4 1.33	6J4 6.98			
1F6 .98	3Q4 1.12	6J5GT .93			
1F7G .98	3Q5GT 1.25	6J6 2.75			
1G4GT .89	3S4 1.05	6J7 1.11			
1G5G .89	3V4 1.05	6J8G 1.29			
1G6GT .98	4B27 4.98	6K4 3.49			
1H4G .89	4B32 11.69	6K5GT 1.16			
1H5G 1.05	4C25/HK54 3.98	6K6GT .91			
1H6G .89	4C33 59.00	6K7 .85			
1J5G 1.20	4C35 34.90	6K8 1.07			
1J6G .89	4C36 15.98	6L5G .89			
1L4 .98	4E27/257 17.85	6L6 3.35			
1LA4 1.23	4J31 95.00	6L6G 3.15			
1LA6 1.33	4J42/700 19.00	6L6GA 2.98			
1LB4 1.33	4J47 260.00	6L7 1.15			
1LC5 1.23	4T4/2 5.95	6N4 2.39			
1LC6 1.33	5C22 59.95	6N6G 1.95			
1LD5 .98	5C30/C5B 9.95	6N7GT 1.26			
1LE3 1.23	5D21 24.30	6P5GT .98			
1LG5 1.33	5J23 13.45	6Q7 .98			
1LH4 1.29	5J29 12.40	6R7 .98			
1LN5 .98	5J32 99.00	6R8 1.39			
1N5GT 1.05	5R4GY 2.25	6S4 .98			
1N6G .98	5T4 1.98	6S7 .98			
1P5GT .98	5U4G .91	6S8GT 1.65			
1P24 2.39	5V4G 1.44	6SA7GT 1.19			
1Q5GT .98	5W4 .81	6SB7Y 1.20			
1Q26 69.00	5X4G .90	6SC7 1.45			
1R4/1294 .98	5Y3GT .69	6SD7GT 1.19			
1R5 1.05	5Y4G .75	6SF5 .98			
1S4 1.20	5Z3 1.09	6SF7 .98			
1S5 .98	5Z4 1.35	6SG7 1.45			
1T4 1.05	C6A 7.45	6SH7GT 1.07			
1T5GT 1.23	6A3 1.65	6SJ7GT 1.19			
1U4/5910 .98	6A4 1.50	6SK7GT 1.19			
1U5 .94	6A5G 2.30	6SL7GT 1.25			
1V .89	6A6 1.10	6SN7GT 1.22			
1V2 .70	6A7 1.39	6SN7WGT 1.90			
1Y2 3.98	6A8GT 1.05	6SQ7GT .98			
1X2A 1.45	6AB4 1.39	6SR7 1.08			
1Z2 3.98	6AB5/6N5 1.33	6SS7 .90			
2A3 1.66	6AB7/1853 1.42	6ST7 1.33			
2A4G 1.20	6AC5GT 1.19	6SU7GTY 3.37			
2A5 .79	6AC7 1.61	6SZ7 1.05			
2A6 .79	6AD7 1.60	6T7G .98			
2A7 .89	6AE5 .89	6T8 2.45			
2B4 2.98	6AE6G .79	6U4GT .95			
2B7 .89	6AF5G .89	6U5/6G5 .98			
2B22/GL559 1.38	6AF6G 1.33	6U6GT 1.05			
2C21/1642 .36	6AG5 1.47	6U7G .79			
2C22/7193 .39	6AG7 1.98	6V6 2.25			
2C26 .25	6AH5G 1.49	6V6GT 1.25			
2C34/RK34 .69	6AH6 2.17	6V6GTY 1.65			
2C39 23.98	6AJ5 1.49	6V7G 1.18			
2C40 12.98	6AK5 1.98	6W4GT 1.08			
2C43 28.50	6AK6 1.33	6W4WGT 1.70			
2C43/464A 16.95	6AL5 1.05	6W5GT .98			
2C44 1.20	6AL7GT 1.89	6W6 1.35			
2C50 3.69	6AN5 5.95	6W7G 1.33			
2C51 5.69	6AQ5 1.11	6X4 .89			
2C52 3.08	6AQ6 1.05	6X5GT .75			
2D21 1.80	6AQ7GT 1.23	6Y5 1.85			
		6Y6G [illegible]			
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307A/RK75 5.45	833A 44.50
310A 6.98	836 3.98
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323B 12.25	838 3.98
327A 2.50	842 2.75
350A 8.95	843 .39
350B 3.50	845 5.95
354A 24.98	851 60.00
355A 14.15	860 12.98
HK357C 39.49	861 49.95
367A 3.98	864 .38
371B .98	865 1.39
380A .79	866A 1.75
388A 2.69	869 28.98
393A 4.98	872A 2.45
394A 4.98	GE872A 4.98
X400 14.98	873 15.98
WL414 63.95	874 1.39
417A 9.49	876 1.95
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446A/2C40 1.19	885 1.80
446B 1.75	893A 250.00
450TH 47.50	922 .98
450TL 44.50	923 1.75
GL451 .89	927/CE25 1.00
460/HF200 15.95	929 1.33
	930 1.05
	931A 4.98
	HK953E 78.00
	954 .25
	955 .49
	956 .39
	957 .39
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7G7/1232 1.33	19T8 1.98	75 .83	WL468 8.95	SD968 .98
7H7 1.11	20 1.17	HY75A 4.59	RH507 9.98	991 .40
7J7 1.23	RK20A 9.90	76 .83	527 35.00	FM1000 1.50
7K7 1.33	RX21 2.50	77 .75	GL530 49.69	1000T 85.00
7L7 1.23	PJ22/CE1C 1.49	78 .83	WL531 3.75	CK1005 .45
7N7 1.22	22 .99	79 .89	WL532A 3.89	CK1006 .64
7Q7 .95	HY24 1.39	80 .74	544 4.98	CK1007 .89
7R7 1.07	24A 1.10	81 1.75	GL546 1.69	HK1054 130.00
7S7 1.23	24G/3C24 .69	FG81A 3.75	550P1 19.95	CK1089 3.98
7T7 1.03	25A6 1.09	82 1.29	575A/975 12.65	CK1090 2.99
7V7 1.33	25A7 3.17	82V 1.39	WL579B 12.98	R1100 5.00
7W7 1.23	25AC5GT 1.61	83 1.29	601B .19	R1130B 12.00
7X7/XXFM 1.23	25B5 1.39	83V 1.54	HY615 .18	HY1231Z 5.39
7Y4 .90	25BQ6GT 1.78	84/6Z4 .94	WL619 18.90	HY1269 5.39
7Z4 .87	25C6 1.18	85 .98	WL632A 8.98	1273 1.15
10Y .79	25L6GT .87	89 .75	701A 6.98	1603 3.00
12A .89	25N6 1.69	VR92 .25	702A/702B 2.65	1609 5.98
12A5 1.39	25W4GT 1.11	DR100 11.49	703A 3.98	1613/6F6X 1.25
12A6 .98	25Y5 .99	100TS 8.89	704A 1.95	1614 2.05
12A7 1.39	25Z5 .90	FG104 35.98	705A/8021 1.25	1616 1.98
12A8GT .89	25Z6GT .91	FG105 18.95	707A 13.50	1619 .29
12AH7GT 1.33	26 .75	VU111 .45	707B 24.98	1620 4.95
12AL5 1.11	27 .75	HY114B .79	710/8011 1.98	1621 1.29
12AT6 .83	FG27A 5.75	HY115/145 .75	710A/8011 1.75	1622 2.26
12AT7 1.61	RK28A 6.95	117L7 1.95	713A 1.00	1625 .49
12AU6 1.11	28D7 1.39	117N7GT 1.95	715A 6.98	1626 .49
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12AV7 1.78	32 .49	117Z6GT 1.20	717A 1.59	1633 .75
12AW6 1.75	FG32 5.98	117Z7GT 1.49	719A 22.75	1634 1.80
12AX7 1.45	32L7GT 1.69	VT127A 3.98	720CY 45.00	1635 1.49
12AY7 5.95	FG33 8.98	F127A 15.89	721A 5.98	1641/RK60 .75
12BA6 1.00	33 .59	CV148 4.98	722A/287 2.75	2050 1.98
12BA7 1.75	34 .79	150T 14.50	723A 9.75	2051 1.80
12BD6 1.45	35/51 1.00	155 .98	723A/B 18.98	R4340 36.00
12BE6 1.00	35A5 .95	FG166 49.00	724A/B 2.89	5514 4.85
12BF6 .85	35B5 1.11	FG172 42.50	724D 12.98	5516 7.75
12BH7 1.33	35C5 1.11	182B 1.20	725A 7.75	5618 3.29
12C8 1.39	35D5 1.11	FG190 12.80	726A 7.98	5656 9.98
12F5 .79	35L6GT 1.00	200 22.98	726B 24.98	5670 5.98
12H6 .89	35TG 4.95	205B/VT2 1.69	726C 69.98	5686 4.23
12J5GT .73	35W4 .69	CE206 3.15	730A 9.89	5687 5.75
12J7GT 1.00	35Y4 .87	211/VT4C 1.89	801 .98	5812 2.99
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12K8 1.07	35Z4GT .75	WE215A .15	803 3.00	HK5944 16.49
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12S8GT .98	REL36/6J4 .50	231 1.20	805 4.98	HK5991 18.00
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12SC7 1.39	37 .69	244A 4.15	808 2.39	UX6653 .69
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12SF7GT .69	39/44 .69	249B 3.75	810 11.96	8013A 5.98
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12SK7 1.25	43 .55	262A 3.98	815 5.98	9003 1.98
12SL7GT 1.07	45 .98	262B 3.98	816/866JR 1.29	9004 .79
12SN7GT 1.22	45S/VT52 .59	271A 6.65	826 .98	9005/RC4B 1.95
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7CP1 12.95	1N27 3.50
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9JP1 14.85	1N32 18.00
9LP7 14.85	1N34 .75
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